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THE RACIAL GEOGRAPHY OF EUROPE.

A SOCIOLOGICAL STUDY.

(*Lowell Institute Lectures, 1896.*)

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XI.—THE BRITISH ISLES.

THE ethnic history of the British Isles turns upon two significant geographical facts, which have rendered their populations decidedly unique among the other states of western Europe.* The first of these is their insular position, midway off the coast between the north and south of the continent. That narrow silver streak between Calais and Dover which has insured the political security and material prosperity of England in later times, has always profoundly affected her racial history. A partial bar against invasion by land, the fatal step once taken, it has immediately become an obstacle in the way of retreat. Invasion thus led inevitably to assimilation. Protected sufficiently against disturbance to assure that homogeneity of type which is attendant upon close contact, the islands at the same time could never suffer from the stagnation which utter isolation implies.

* For invaluable assistance I am deeply indebted to Dr. John Beddoe, F. R. S., late President of the Anthropological Institute of Great Britain, of Bradford-on-Avon, Wilts, not only for the loan of rare material for the illustration of this particular paper, but for kindly criticism and interest throughout our whole series. To President E. W. Brabrook, C. B., of the Anthropological Institute, London, also, I would acknowledge most gratefully my obligation. Recognition should be made of the courtesy of Mr. J. A. Webster, secretary, as well. The complete collection of photographs of the Institute has not

We are still further assured of the truth of these geographical generalizations on comparison of the racial history of England with that of Ireland; for we thereby have opportunity to observe the effects of different degrees of such insularity. In the latter case, it

AN IRISH TYPE. Gray eyes, brown hair. Arran Islands, Galway.

has become a bit too pronounced to be a favorable element in the situation. Disregarding her modern political history—for we are dealing with races and not nations—it is indeed true, as Dr. Beddoe says, that Ireland "has always been a little behindhand." Ethnic invasions, if they took place at all, came late and with spent energy; most of them, as we shall see, whether of culture or of physical types, failed to reach her shores at all. These laws apply to all forms of life alike. Thus the same geographical isolation which excluded the

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only been opened to us, a large part of it has even been subjected to the perils of transportation to America for our benefit. From these two sources all of our portraits are derived.

Authorities comprehensively treating the anthropology of the British Isles are very few. Pre-eminent is Dr. John Beddoe's Races of Britain, Bristol and London, 1885; and his Stature and Bulk of Man in the British Isles, in Memoirs of the Anthropological Society of London, iii, 1870. A full list of a score or more of his scattered papers will be found in our Bibliography of the Anthropology of Europe, now in preparation, to appear in Bulletins of the Boston Public Library. The monumental work of Davis and Thurnam, Crania Britannica, two volumes, London, 1865, covers the whole subject of past and present populations. An essay, On Some Fixed Points in British Ethnology, by the late T. H. Huxley, in the Contemporary Review for 1871, is a convenient summary, with no attention to the evidence of craniology, however. Finally, the reports of the Anthropometric Committee of the British Association for Advancement of Science, especially its last one in 1883, should not be omitted. Many other papers of local importance are named in our Bibliography above mentioned.

snakes of the mainland from Ireland—we are speaking seriously of an established zoölogical fact and not a myth—was responsible for the absence of the peculiar race of men who brought the culture of bronze and other arts into England in prehistoric times. It also accounts for the relative scarcity of the Teutonic invaders afterward. As we may grade both the flora and fauna of the islands in variety of species from the continent westward, so also may we distinguish them anthropologically. In flora, Ireland has but two thirds the species indigenous to England and Scotland; for the same reason her human population contains much less variety of human type.* Among the Irish peasantry there are no such contrasts as those we shall show to exist between the highland and the lowland Scotch, or between the Englishman in Cornwall and in Yorkshire.

A second geographical peculiarity of the British Isles has not been devoid of importance to us. The eastern island contains both extremes of fertility and accessibility. Ireland is far more uniform. A point for us to note is that the backbone of each island lies along the west coast. Both England and Scotland certainly present their best sides to the continent; all the way from Caithness to Kent either the most fertile lands, or the mouths of rivers leading to them, lie on the east. The same thing is mainly true of Ireland. The result, of course, is the accentuation of the contrasts between the populations of the east and west sides in either case. The best lands are at the same time nearest the mainland. All incentive to further invasion ceases at once. The significance of this will appear in due time. We may realize its importance in advance, however, by supposing the situation reversed, with the goal of all invasions on the farther side of each island. Is there a doubt that Wales, the western Scottish highlands, and farther Ireland would have been far more thoroughly infused with foreign blood than they are in reality to-day? It makes a great difference whether a district is on the hither or the hinter side of Canaan.

The most remarkable trait of the population of the British Isles is its head form; and especially the uniformity in this respect which is everywhere manifested. The prevailing type is that of the long and narrow head, accompanied by an oval rather than the round face. This uniformity makes the task of illustrating types by means of portraits peculiarly difficult; for the shape of the head is the main characteristic directly shown by them. It should also always be borne in mind that when we speak of broad or oval faces we refer to the proportions of the bony framework alone. We must look below the flesh, behind beard or whiskers, or else endless confusion will result. Full cheeks need not imply a broad face as we mean it;

* Sir A. Geikie, in Macmillan's Magazine, March, 1882, pp. 367 *seq.*

the width at the malar bones is the crucial test. Measured by the cephalic index—that is, the extreme breadth of the cranium expressed in percentage of its length from front to back—the uniformity in type is so perfect that it can not be represented by shaded maps as we have heretofore been accustomed to do. Wherever heads have been measured, whether in the Arran Islands off the west coast of Ireland, the Hebrides and Scottish Highlands, Wales and Cornwall, or the counties about London, the results all agree within a few units. These figures, noted upon the localities where they were taken, are shown upon our little sketch map on this page. It will be observed at once that the indexes all lie between 77 and 79, with the possible exception of parts of Scotland, where they fall to 76.

What do these dry statistics mean? In the first place, they indicate a living population in which the round-headed Alpine race of central Europe is totally lacking; an ethnic element which, as we have already shown in our preceding articles, constitutes a full half of the present population of every state of middle western Europe—that is to say, of France, Belgium, Italy, and Germany. We have already proved that this Alpine race is distinctively a denizen of mountainous regions; we christened it Alpine for that reason. It clings to the upland areas of isolation with a persistency which even the upheavals of the nineteenth century can not shake. Almost everywhere it appears to have yielded the seacoasts to its aggressive rivals, the Teutonic long-headed race in the north and the dolichocephalic Mediterranean one on the south. This curious absence of the broad-headed

Alpine race in the British Isles therefore is merely another illustration of its essentially continental character.

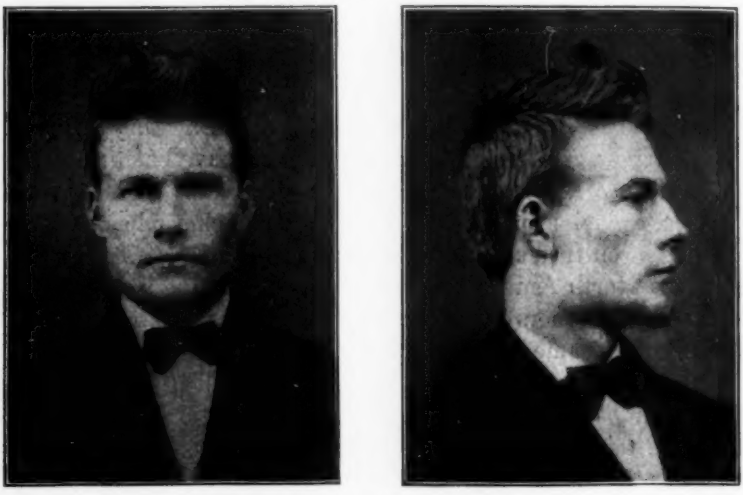
Before we proceed to consider the other physical traits of the living population, we must draw in a background by a hasty summary of the facts which the science of archæology has to offer concerning the prehistoric human types in the islands. In the first place, it is certain that the earliest inhabitants were decidedly long-headed, even more so than any Europeans of to-day; far more so than the present British. The evidence concerning this most primitive stratum is carefully presented by Boyd Dawkins in his Early Man in Britain. These men, whose remains have been unearthed in caves and whose implements have been discovered in the river drift of the late glacial epoch, were decidedly dolichocephalic. Both in the stage of culture attained and in head form they were so like the Eskimo of North America that Nilsson more than a half century ago suggested a common derivation for both. Boyd Dawkins lends his support to the same hypothesis, assuming that as the ice sheet withdrew to the north, these primitive folk followed it, just as we know to a certainty that the mammoth, mastodon, and other species of animals have done. A former connection of Europe with Greenland would have made this migration an easy matter. Whether this interesting supposition be true or not, we know that the earliest type of man in Britain was as long-headed as either the African negro or the Eskimo—that is to say, presenting a more extreme type in this respect than any living European people to-day.

The second population to be distinguished in these islands was characterized by a considerably higher culture; but it was quite similar, although somewhat less extreme in physical type than the preceding one, so far as we can judge by the head form. This epoch, from the peculiarities of its mode of interment, is known as the long-barrow period.* The human remains are found, often in considerable numbers, generally in more or less rudely constructed stone chambers, covered with earth. These mounds, egg-shaped in plan, often several hundred feet long, are quite uniform in type. The bodies are found at the broader and higher end of the tumulus, which is more often toward the east, possibly a matter of religion, the entrance being upon this same end. These people were still in the pure stone age of culture; neither pottery nor metals seem to

* The best authorities upon this and the succeeding type are Canon Greenwell's British Barrows, with its anthropological notes by Dr. Rolleston, at pages 627–718; the Crania Britannica above mentioned, but more especially the essays by Dr. Thurnam in Memoirs of the Anthropological Society of London, vol. i, pp. 120–168, 458–519; and vol. iii, pp. 41–75. Consult also Rolleston in Journal of the Anthropological Institute, London, vol. v, pp. 120–172.

have been known. But a distinct advance is indicated by the skillfully fashioned stone implements. Such long barrows occur most frequently in the southwest of England, in the counties of Wilts and Gloucestershire, especially in the bleak uplands of the Coteswold

Shetland Islands.



Scandinavian Mixed Type.

"Old Black Breed" Type.

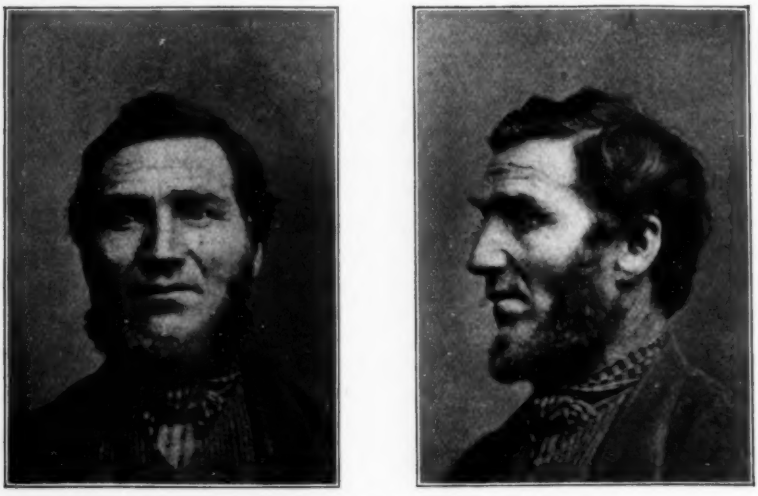
Hills; but they are also found much farther north as well. The people of this period were, as we have said, like their predecessors, extremely long-headed. The cephalic index in the life was as low as 72, several units below any average in Europe to-day, save per-

haps in parts of Corsica. It is worthy of note also that a remarkable purity of type in this respect was manifested; positively no broad crania with indexes above 80 have ever been found. These long-barrow men were also rather undersized, about five feet five inches—that is to say, an inch shorter than any average prevailing to-day. The full significance of this important point will appear shortly. The evidence seems to bear out the conclusion that thus far we have to do with but one race type, which had, however, slowly acquired a low stage of culture by self-education.

This neolithic, or stone age, primitive type is still represented in the present population, according to the testimony of those best fitted to judge. Our portrait herewith of an ancient British type, locally known in the Shetland Isles as "the old black breed," because of its accentuated brunetteness, is probably a good specimen. The long head and dark complexion are said to-day to be more often associated with short stature than otherwise.

The next event in the prehistoric history of the British Isles—pardon the bull, it conveys our meaning—is of profound significance. Often directly superposed upon the relics of the long-barrow period, and in other ways indicating a succession to it in time, occur the remains of an entirely different racial type. This stratum represents the so-called round-barrow period, from the circumstance that the burial mounds are no longer ovoid or elongated in ground plan, but quite circular or bell-shaped. The culture is greatly superior to that of its predecessor. Pottery, well ornamented, occurs in abundance, and the metals are known. Bronze implements are very common, and even a few traces of iron appear. Now the dead are often buried in urns, showing that incineration must have been practiced. More remarkable than this advance in culture, and more directly concerning our present inquiry, the people were as broad-headed as the modern peasants of middle France. The cephalic index was fully ten points on the average above that of the long-barrow men, averaging about 83 in the life. The former type has not entirely disappeared, but it is in a decided minority. So persistent is the difference that Dr. Thurnam's well-known axiom, "long-barrow, long skull; round-barrow, round head," is accepted as an ethnic law. It is impossible to emphasize too strongly the radical change in human type which is hereby implied. The contrast is every whit as marked as that between a modern Alpine peasant and a south Italian or Scandinavian. The new population differed in still another important respect from the underlying one. This is known from scores of detailed measurements of skeletons. The average stature was fully three inches greater, rising five feet eight inches. The round-barrow population therefore attained a bodily

height more respectable as compared with the present living one than its stunted predecessor. Dr. Beddoe has selected the accompanying portrait as representing this almost extinct broad-headed type of the bronze age. It is said to be not uncommon in the remoter



ROUND-BARROW BRONZE-AGE TYPE. Cumberland.

parts of Cumberland. The heavy brow ridges seem to be a noticeable peculiarity of it.

The generally accepted view among anthropologists to-day is that the round-barrow men came over from the mainland, bringing with them a culture derived from the east. We can never know with certainty whether they were Celtic immigrants from Brittany; where, as we have already shown, a similar physical type prevails to-day—such is Thurman's view: or whether they were the vanguard of the invaders from Denmark, where a round-headed type was for a time well represented, an opinion to which Dr. Rolleston inclines. This latter hypothesis is strengthened by study of the modern populations, both of Norway and the Danish peninsula. For example, turn for a moment to our map on page 158, showing the head form in Scandinavia to-day. Notice how the tints darken, that is to say, the heads broaden, in the southwest corner of Norway. The same thing is true just across the Skager Rack in Denmark proper, where the round-headed type is still more frequent than immediately to the south in Schleswig-Holstein and Hanover. This neighborhood was once a distinct subcenter of distribution of this type. It might readily have come over to England from here, as the Jutes, Angles, and Saxons did a few centuries later. Differing in these details as to their precise geographical origin, all authorities

are nevertheless agreed that the round-barrow men came from the continent somewhere. Any other derivation would have been an impossibility. We also know that this Alpine immigrant type overran all England and part of Scotland. It never reached Ireland because of its remoteness; with the result that greater homogeneity of type prevails therein, while at the same time the island was deprived of a powerful stimulus to advance in culture. This is the first indication of the geographical handicap under which Erin has always labored. Finally, we have to note that this broad-headed invasion of the round-barrow period is the only case where such an ethnic element ever crossed the English Channel in numbers sufficient to affect the physical type of the aborigines. Even here its influence was but transitory; the energy of the invasion speedily dissipated; for at the opening of the historic period, judged by the sepulchral remains, the earlier types had considerably absorbed the newcomers.

The disappearance of the round-barrow men is the last event of the prehistoric period which we are able to distinguish. Coming, therefore, to the time of recorded history, we find that every influence was directed toward the complete submergence of this extraneous broad-headed type; for a great immigration from the northern mainland set in, which, after six hundred years of almost uninterrupted flow, completely changed the complexion—we speak literally as well as figuratively—of these islands. The Teutonic invasions from Germany, Denmark, and Scandinavia are the final episodes in our chronicle. They bring us down to the present time. They offer us a brilliant example of a great ethnic conquest as well as of a military or political occupation. The Romans came in considerable numbers; they walled cities and built roads; they introduced new arts and customs; but when they abandoned the islands they left them racially as they were before; for they appear to have formed a ruling caste, holding itself aloof in the main from intermarriage with the natives. Not even a heritage of Latin place names remains to any considerable degree. Kent and Essex were of all the counties perhaps the most thoroughly Romanized; and yet the names of towns, rivers,

ANGLO-SAXON BLONDISH TYPE.
Surrey.

and hills were scarcely affected. The people manifest no physical traits which we are justified in ascribing to them. The Teutonic invasions, however, were of a different character. The invaders, coming perhaps in hopes of booty, yet finding a country more agreeable for residence than their barren northern land, cast in their lot with the natives in many districts forming the great majority of the population. We find their descendants all over Britain to-day.

These Teutonic invaders were all alike in physical type, roughly speaking. We can scarcely distinguish a Swede from a Dane to-day, or either from a native of Schleswig-Holstein, or Friesland, the home of the Jutes, Angles, and Saxons. They are all described to us by chroniclers, and our modern research corroborates the testimony, as tall, tawny-haired, fiercely blue-eyed barbarians. Evidence there is indeed that the Alpine broad-headed race once effected a lodgment in southwest Norway, as we have already said. Our map of that country on a subsequent page shows a persistence greatly attenuated, of that trait all along the coast. Archæology shows it to have invaded Jutland also in early times; but it seems to be of secondary importance there to-day. The Danes are somewhat broader-headed than the Hanoverians perhaps, but, practically speaking, they are all tall and blond Teutons.

Since we can not follow these invaders over Britain by means of their head form, they being all alike and entirely similar to the already prevailing type in the British Isles previous to their advent, we must have recourse to a contributory kind of evidence. We have at times made use of the testimony of place names heretofore; but it is nowhere else in Europe so clear or convincing as in this particular case. We may trace with some surety each current of the great Teutonic inundation by means of them. Then, having done this and completed our historical treatment of the subject, we may once more take up the main thread of our argument by returning to the study of the living population. We shall thus have the key to the situation well in hand. The distribution of color of hair and eyes and of stature will have a real significance.

Our map on next page, adapted from Canon Taylor's exceedingly valuable little book entitled Names and Places, will serve as the mainstay of our summary. In choosing our shading for it, we had one object in mind, which we can not forbear from stating at the outset. The three shades denoting the Teutonic place names are quite similar in intensity and sharply marked off from the Celtic areas, which we have made black. This is as it should be, for the whole matter involves a contrast of the three with the one which we know to be far more primitive and deep-seated. The witness of spoken language, to which we shall come shortly, would suffice to

CAITHNESS
SHETLAND ISLES
ISLANDS
LEWIS
HEBRIDES
SKYE
Moray Firth
MULL
ISLAY
Firth of Forth
Tweed R
Donegal Bay
Solway Firth
Tees R
LANCASTER
Humber R
The Wash
Galway Bay
DUBLIN
WATERFORD
Pembroke
Bristol Channel
Thames R
I.&R.
Isle of Wight
PLACE NAMES
'BRITISH ISLES.
AFTER TAYLOR '93 by Permission.
NORWEGIAN
DANISH
SAXON
CELTIC

confirm this, even had we no history to which to turn. Our map shows at a glance an island where once all the names of natural features of the landscape and of towns as well were Celtic. This primitive layer of names has been rolled back by pressure from the direction of the mainland. It is a unit opposed to the combined aggression of the Germanic tongues.

The Jutes, Angles, and Saxons set the Teutonic ball a-rolling. They came from the northern coast of Germany, from the marshes and low-lying country of Friesland. These barbarians seem to have followed close upon the heels of the retiring Romans, making their appearance about the year 400 of our era. The whole island lay open to them, and they made haste to overrun the best of it. They avoided the fens and forests, to which the natives withdrew. Within two hundred years their influence had extended even to the uttermost parts of Ireland, over the whole of which, as our map shows, Saxon village names sporadically occur. The main center of their occupation was in the southeast and middle of England, where, from their first landings in Kent and Essex, they transformed the entire country. Scotland also, south of Edinburgh, was infused with Saxon blood if we may judge from our map. This district, from the river Tees to the Forth, is in fact, as Taylor says, as purely English as any part of the island. The Lothians were reputed English soil until the eleventh century. Scotland begins racially not at the political boundary of the river Tweed and Solway Firth, but at the base of the Grampian Hills. The correspondence of a map of physical geography and of Celtic place names in Scotland shows a relation of cause and effect.

This first inoculation with Teutonic blood was an unwilling one. We have every evidence that the struggle was bitter to the end. The tale of Saint Guthlac, a devout Briton, shows it. Disturbed in his meditations one night by a great uproar outside his hermit hut, he engaged himself in prayer for preservation until the morning. The chronicler tells us that he was much relieved at daybreak by the discovery that the midnight marauders were *only devils* and not Saxons. So strong was the race antipathy that the laws forbade a Briton from drinking from a cup touched by a Saxon till it had been scoured with sand or ashes. Two hundred years of such a struggle could not but modify the purity of the native stock, as we shall be able to prove.

About the year 850 came the second installment of the Teutonic invasion at the hands of the Danes. They put an end to the inroads of their Saxon predecessors by attacking them in the rear. Two contrasted kinds of expeditions seem to have been dispatched against the island. Those which besieged London and skirted the southern

coasts were mainly piratical; few names indicating any permanent settlement occur. These Danes were in search of booty alone. Farther north, especially in Lincolnshire and its vicinity, the character of the names betokens intentional colonization, and a very intensive one at that. Thus, nearly a quarter of all the village names in Lincolnshire terminate in "by," as Whitby, Derby, and the like. The Saxon equivalent for this Danish word for village is "ham" or "ton," as Buckingham and Huntington. The line of demarcation of Danish settlement on the south is very sharp. The fens deterred them from extending in this direction, for the marshes were long a stronghold of the British, as we have seen. From the Wash north over Yorkshire to the Tweed they occupied and settled the country effectively. Three hundred years were necessary to accomplish this result.

SCANDINAVIAN TYPES.
Lewis, Hebrides Islands.

The Norwegians, coming next, mainly confined their attention to the northern and western coasts of Scotland, shunning their vigorous competitors to the south. They attacked the island from the back side. The fringe of Norse place names upon our map is very striking. These Teutons rarely penetrated far inland in Scotland, especially along this west coast, for here the country is rugged; the only means of communication is by sea; so that the isolated colonies of "baysmen" were speedily absorbed. On the islands—the Shetlands, Orkneys, and Hebrides—the case was different. Here the aborigines were often entirely replaced by a purely Scandinavian population. Such a family with strongly accentuated Norwegian peculiarities is depicted herewith. Its contrast with the aboriginal dark population, the "old black breed," shown on a preceding page, needs no comment. The effect of a lesser Teutonic strain in the old stock is clearly manifested in the second type which accompanies our previous portrait. One reason for the Teutonization of these islands is that

they were really wintering stations and bases of supplies for the expeditions along the coasts of Scotland, Ireland, and Wales during the summer season. The only other district where Norse settlements occur in frequency is, as our map shows, in Lancashire and the lake district. This may also have been a center whence expeditions all about the western coasts took place, planting little stations where opportunity offered.

The Normans, last of the Germanic series, came to the islands after they had become so infiltrated with Teutonic settlements that but few traces of them separately can be detected. They did not come as they entered Normandy, as colonizers; but as political conquerors, a few thousand perhaps, forming a ruling class, just as the Franks invaded south Germany or Burgundy. Their influfluence is most strongly shown in York and parts of Lancashire and Durham. Much of the land here they laid entirely waste; what they did with the native owners we can only surmise. At a later time a gradual influx of Norman blood made itself felt in the south and east of England, so that Dr. Beddoe concludes that by the time of Edward I perhaps a fifth of the population was of Norman descent more or less indirectly.

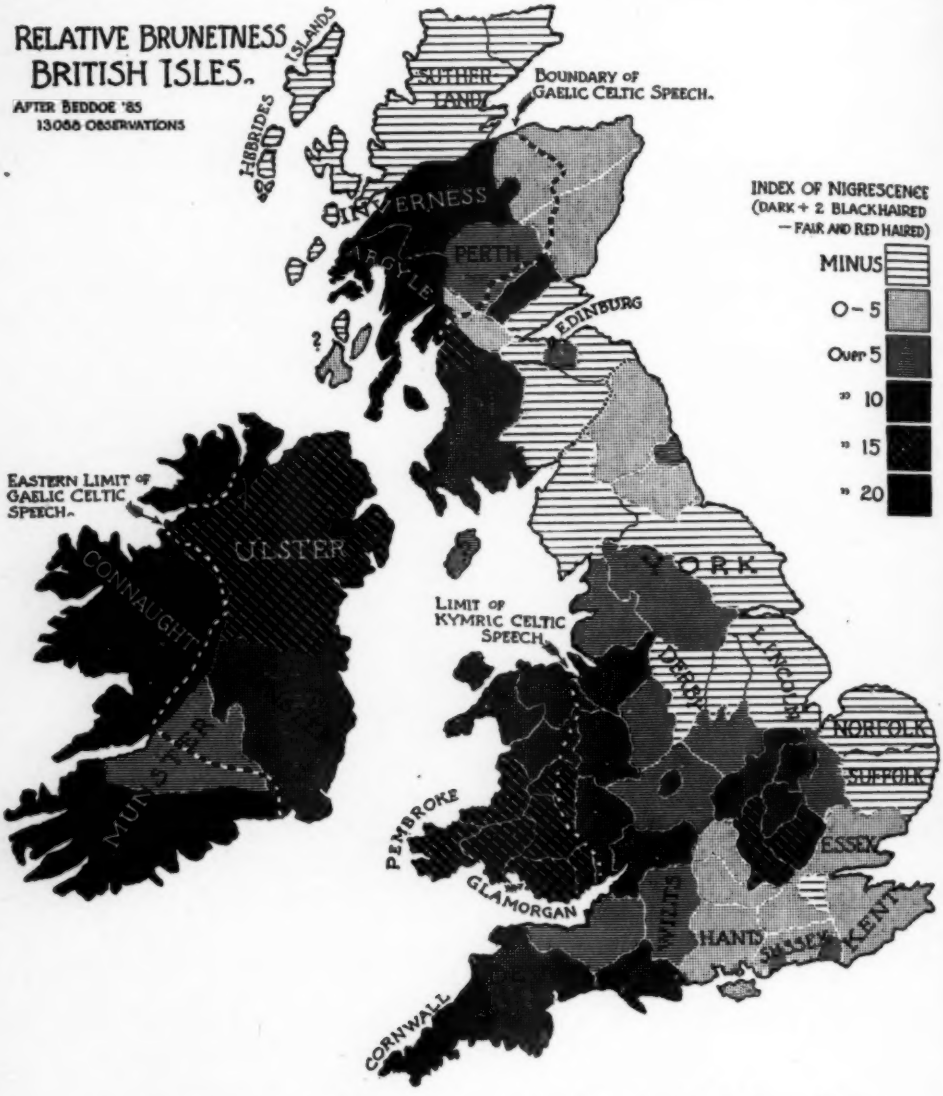
The Teutonic immigration had now run its course. The islands were saturated. Let us see what the anthropological effect has been by returning once more to the consideration of physical characteristics alone.

We are now prepared to show why it is that in head form the

population of the British Isles to-day is so homogeneous. The average cephalic index of 78 occurs nowhere else so uniformly distributed in Europe, nor does it anywhere else descend to so low a level, save at the two extremes of the continent in Scandinavia and Spain. For purposes of comparison we have reproduced two maps of these regions herewith. Of Norway we know more in detail than of Sweden, thanks to the indefatigable Dr. Arbo; but the one country is typical of the other. These maps make it clear beyond a shadow of doubt that in these two outlying members of Europe we have to do with relatively homogeneous populations in this respect. Other facts in our possession prove that this uniformity of head form is the concomitant and index of two relatively pure, albeit widely different, ethnic types—Mediterranean in Spain, Teutonic in Norway. Purity of descent in each case—that is to say, freedom from ethnic intermixture—is the direct and inevitable outcome of peninsular isolation. It is now proper to ask—and this is the crucial question, to whose elucidation all of our argument thus far has been contributory—whether we may make the same assumption of racial purity concerning the British popu-

lations. We have a case of insularity even more pronounced than in Spain or Norway; we have cephalic uniformity. The interest of our problem intensifies at this juncture. If relatively pure, have we to do with the type of the Teuton, or of the Iberian race? We

are generally known as Teutonic by descent. Or is there some complex product here made up of both ethnic elements, in which



case the apparent homogeneity revealed by the head form is entirely specious and misleading? As our mainstay in such matters, cephalic index, fails us utterly, since both north and south are precisely alike in this respect, we must rely upon the other, albeit less stable, physical traits. To these we turn next in order.

A glance at the accompanying map of relative brunetteness suffices to show a curious increase of pigmentation from northeast

to southwest, measured by the prevailing color of the hair.* The map is almost the exact counterpart of our preceding one of place names. From our previous articles we might have been led to expect such an increase from north to south; for that is the rule in every continental country we have studied. The phenomenon we found to be largely a matter of race; but that physical environment, notably climate, played an important part. Moreover, we proved that in elevated districts some factor conduced to increase the blondness, so that mountains more often contained a fairer population than the plains roundabout. Here is a surprising contradiction of that law, if law it be; for the Grampian Hills in Scotland, wild and mountainous Wales, and the hills of Connemara and Kerry in western Ireland, contain the heaviest contingent of brunette traits in the islands. The gradation from east to west is in itself a flat denial of any cli-

BRUNETTE TYPE. Welshman. Montgomeryshire.

matic influence, for the only change in that direction is in the relative humidity induced by the Gulf Stream.

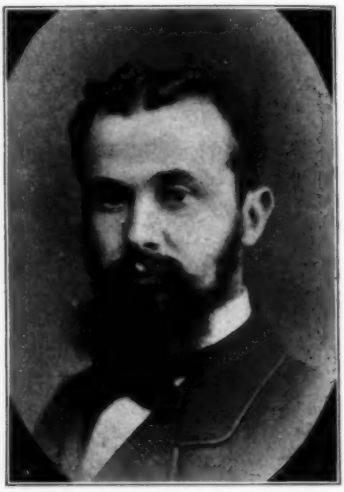
The darkest part of the populations of these islands constitutes the northern outpost of that degree of pigmentation in Europe. Western Ireland, Cornwall, and Argyleshire in Scotland are about as dark, roughly speaking, as a strip across Europe a little farther

* This map is constructed upon a system adopted by Dr. Beddoe as an index of pigmentation. It differs from others mainly in assigning especial importance to black hair as a measure of brunetteness, on the assumption that a head of black hair betrays twice the tendency to melanosity of a dark brown one. Without accepting this argument as valid, the map in question seems to accord best with others constructed by the measurement of pure light and dark types on the German system. Dr. Beddoe regards this one as best illustrating the facts in the case.

south, say from Normandy to Vienna. Even in these most brunette areas pure dark types are not very frequent. No such extremes occur as Italy and southern France present. The prevailing combination is of dark hair and grayish or hazel eyes. Such is particularly the case among the western Irish and southern Welsh.* So striking is the brunetteness in the latter case that we find an early writer in this century, the Rev. T. Price, ascribing the prevalence of black hair in Glamorganshire to the common use of coal as fuel. Without accepting this hypothesis, we may be certain of the strongly accentuated brunetteness of the peasantry hereabouts. The accompanying Welsh type, strongly brunette, with black hair, is a good example. The opposite extreme of blondness corresponds, as nearly as we can judge, to the continental populations in the latitude of Cologne. Light hair and brown or blue eyes become common. This is not as fair as the pure Teutonic race in Scandinavia. We shall probably not be far wrong in the statement that the extremes

Scottish Highlands.

TALL, LIGHTER TYPE. Moray.



"A GOOD SPECIMEN OF THE LITTLE DARK RACE." Argyleshire.

in the British Isles are about as far separated from one another as Berlin is from Vienna. In the darkest regions pure brunette types are more frequent than the blond by about fifteen per cent. In the eastern and northern counties, on the other hand, the blondes are in a majority by an excess of about five per cent. Everywhere, however,

* The recent work of Haddon and Browne, published in the Proceedings of the Royal Irish Academy, Dublin, since 1893, on the western Irish, is our best recent authority on this people.

all possible crossings of characteristics appear, proving that the population is well on the road toward homogeneity. It is especially worthy of note that blondness in some districts often takes the peculiar form of freckled skin and red hair. We in America are familiar with the two types of Irish—one thus constituted, while the other is more often compounded of the black or dark brown hair and steel-blue eyes. It seems, from everyday observation, as if this latter variety were far more common among the women in our immigrants from Ireland. A similar contrast is remarkable in Scotland. Here, in fact, in some districts red-headedness is more frequent than anywhere else in the world, rising sometimes as high as eleven per cent. Topinard has undertaken to prove in France that this phenomenon is merely a variation of blondness.* At all events, his maps show that red hair is most frequent in the lightest departments. In Scotland the same rule applies, so that the contrasts between east and west still hold good. The Camerons and Frasers are as dark as the Campbells are inclined to red-headedness.

CORNWALL TYPE. Black hair and eyes.

Seeking for the clew to this curious distribution of brunetteness in the British Isles, we may make use for a moment of the testimony of language. The Celtic speech is represented to-day by Gaelic or Goidelic, which is in common use in parts of Scotland and Ireland; and secondly by Kymric or Brythonic, which is spoken in Wales. It was also spoken in Cornwall until near the close of the last century, when it passed into tradition. On our map of brunetteness we have roughly indicated the present boundaries of these two branches of the Celtic spoken language. It will be noted at once that the darkest populations form the nucleus of each of the Celtic language areas which now remain, especially when we recall what we have just remarked about Cornwall. Leaving aside for the moment the question whether this in any sense implies that the original Celts were a dark people, let us be assured that the local persistence of the Celtic speech is nothing more nor less than a phenomenon of isolation to-day. The aggressive English language

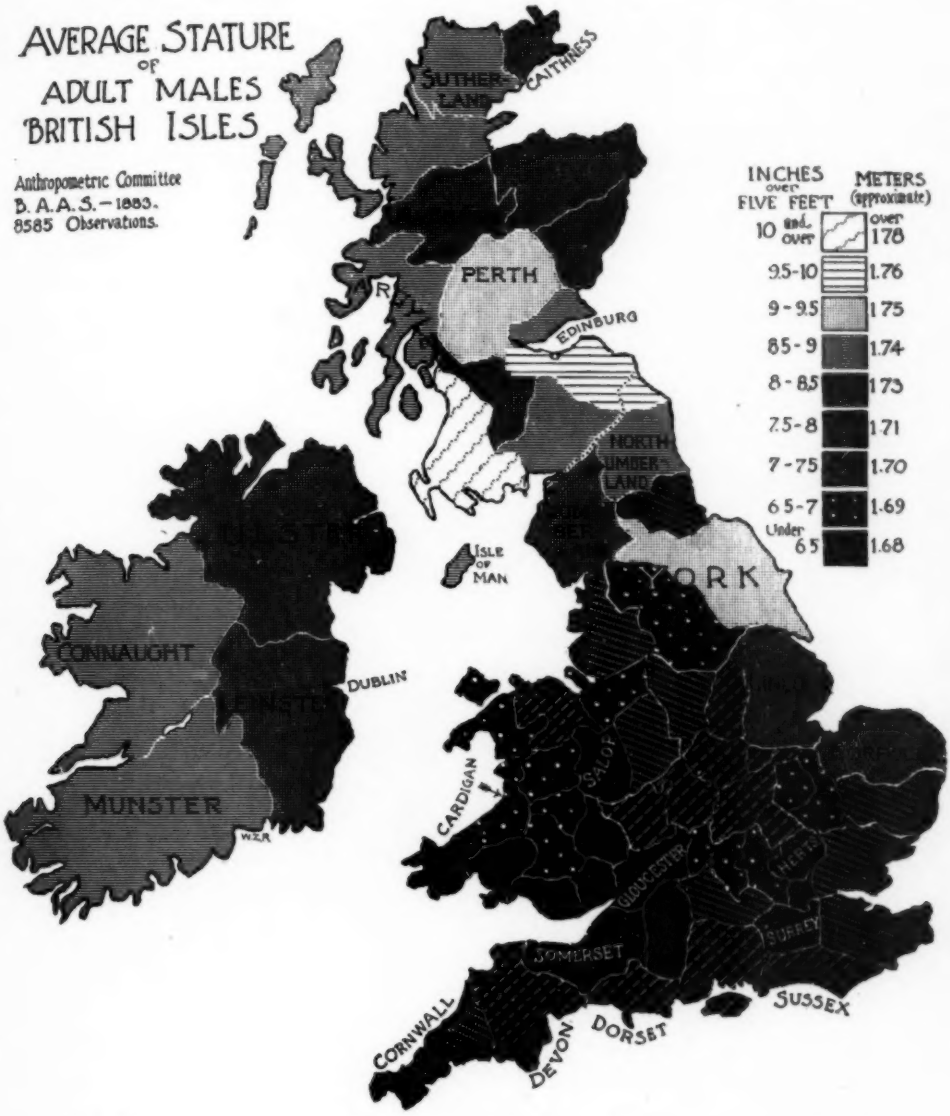
* L'Anthropologie, iv, 1893, pp. 579 *seq.*

has been crowding its predecessor to the wall in every direction.* This has been proved beyond all possible doubt. In the nooks and corners, the swamps and hills, where the railroad and the newspaper are less important factors in everyday life, there we find a more primitive stratum of language. Is it not justifiable for us, from the observed parallel between speech and brunetteness, to assume also that of the two the darkest type in the British Isles is the older? Such is our argument. One detail of our map confirms us in this opinion. Notice the strongly marked island of brunetteness just north of London. Two counties, Hertfordshire and Buckinghamshire, are as dark as Wales, and others north of them are nearly as unique. All investigation goes to show that this brunette outcrop is a reality. It is entirely severed from the main center of dark eyes and hair in the west by an intermediate zone as light as Sussex, Essex or Hampshire (Hants). The explanation is simple. We have already shown that the south Saxons entered England by the back door. They spread inland from the southern coast, prevented from following up the Thames by the presence of London. On the other side the same invaders pushed south from the Wash and the Humber. These two currents joined along the light intrusive zone. Our dark spot is the eddy of native traits, persistent because less overrun by the blond Teutons. The fens on the north, London on the south with dense forests in early times, left this population relatively at peace. This, history teaches us. Natural science corroborates it strikingly. In a later article, considering purely social phenomena, we shall show that peculiarities in suicide, land tenure, habits of the people, and other details of these counties are likewise the concomitants of this same relative isolation. The fact is all the more striking because the district lies so close to the largest city of Europe.

This variation of brunetteness in Britain is not a modern phenomenon. The contrast between northeast and southwest, while of course largely a result of the Teutonic invasions of historic times, should not be entirely ascribed to them. They have in all likelihood merely accentuated a condition already existing. This we assume from the testimony of Latin writers. In fact, Tacitus' statements, the mainstay of the hypothesis of an Iberian substratum of population in Britain, prove that long before the advent of the Saxons several distinct physical types coexisted in Roman Britain. One of these, he tells us in the eleventh chapter of his Agricola, was the Caledonian, "red-haired and tall"; the other, that of the Silures in southern Wales, with "dark complexion and curly hair." He also

* Ravenstein has mapped it in detail for different decades in the Journal of the Royal Statistical Society, London, vol. xlii, 1879, pp. 579–643.

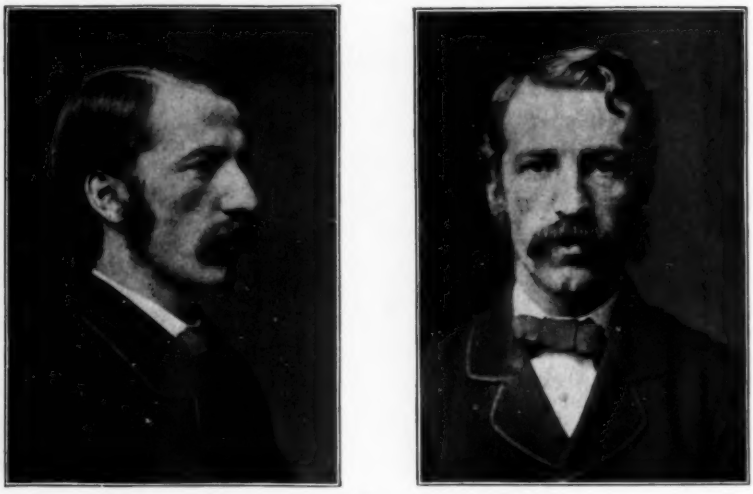
notes the similarity in appearance between the southern Britons and the Gauls, and suggests a Germanic origin for the Caledonians, an Iberian one for the Welsh, and a Gallic one for the English.[2] This is positively all that he said upon the subject, never having been



in the country. Then Jornandes, a mediæval Italian commentator, added fuel to the flame by amending Tacitus' words concerning the Silures of Wales, giving them not only "dark complexions," but "*black*, curly hair." Such were the humble beginnings of the

Iberian hypothesis, notwithstanding which it has passed current for generations as if founded upon the broadest array of facts. What if we should conclude that the assumption is correct in the light of modern research! It is no justification for the positiveness with which the law has been laid down by hosts of secondary writers. By such a tenuous historical thread hangs many another ethnic generalization. May the day come when the science of anthropology assumes its due prominence in the eyes of historians, and renders the final judgment in such disputed cases of physical descent!

Thus far all has been plain sailing. It seems as if the case were clear. An Iberian brunette, long-headed substratum, still persistent in the western outposts of the islands, dating from the neolithic long-barrow period, or even earlier; and a Teutonic blond one, similar in head form in all the eastern districts overrun from the continent, seem to be indicated. Now we have to undertake the addition of a third physical trait—stature—to the others, and the complexity of the problem appears. Our map on page 165 shows that the British Isles contain variations in average of upward of four inches. Scotland, as we have shown elsewhere, contains positively the tallest population in Europe and almost in the entire world. Even the



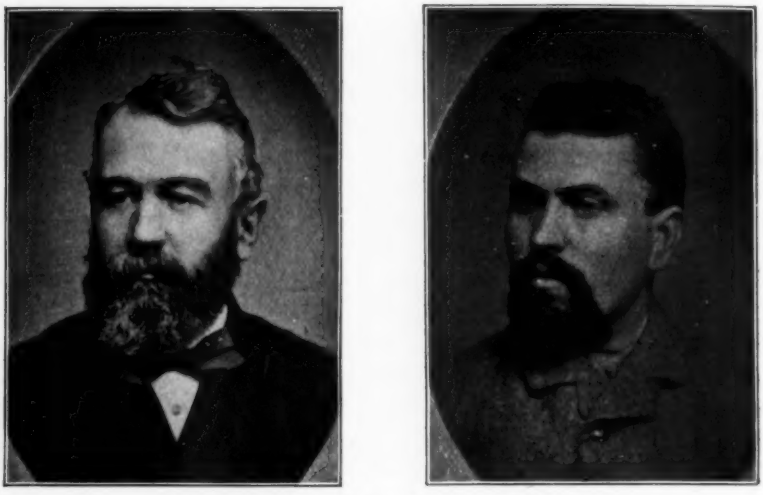
BRUNETTE WELSH TYPE. Cardiganshire.

average of five feet six inches and over in Wales and southwest England is not low; for this is greater than any on the continent south of the Alps. Broadly viewed, the facts in England alone seem to fit our hypothesis. Here we observe the eastern counties relatively tall, with a steady decrease as we pass westward, culminating in southern Wales. The ancient Silures or their modern descendants

are still relatively short, with an average stature but an inch or so greater than the long-barrow men of the stone age. For England, then, the maps of brunetteness and of average stature agree remarkably well. Our portrait herewith represents this common Welsh type. In this case the hair was very deep brown, with dark eyes. The slender build and short stature are characteristic. Even the curious dark spot north of London, which we have already identified as an ancient British outcrop, appears clearly upon our map. It seems to be nearly severed from the western short populations by an intermediate and seemingly intrusive zone of taller men. As a rule, coast populations all over England are taller than inland ones. Even Ireland does not seriously embarrass our hypothesis of a primitive dark and short population. The eastern half, to be sure, is shorter than the western; but a variation of half an inch is not very much, and we know that the Irish are much more homogeneous than the English or Scotch in color of hair and eyes. The western half ought certainly to be shorter to fit our hypothesis exactly, but we might possibly ascribe this to chance, to an inadequate statistical basis, or some other cause.

Consideration of the distribution of stature in Scotland, however, is enough to reduce the consistent anthropologist to despair. The physical traits seem to cross one another at right angles. Inverness and Argyleshire, as brunette as any part of the British Isles, equaling even the Welsh in this respect, are relatively well toward the top in respect of stature. This is all the more remarkable since this mountainous and infertile region might normally be expected to exert a depressing influence. To class these Scotchmen, therefore, in the same Iberian or neolithic substratum with the Welsh and Irish is manifestly impossible. The counties south of them, where stature culminates for all Europe, are also fairly dark. Only two explanations seem possible. Either some ethnic element, of which no pure trace remains, served to increase the stature of the western Highlanders without at the same time conducing to blondness; or else some local influences of natural selection or environment are responsible for it. Men with black hair are indeed shorter in many places, but the averages shown on our map belie any general law in that direction. We have no time to discuss the phenomenon further in this place. As Dr. Beddoe acknowledges, the difficulty is certainly a grave one. At all events, a profound contrast in respect of stature between the two branches of the Celtic-speaking peoples is certain. The only comforting circumstance is that we thus find in language some indication of a very early division of the Gael from the Brython. On the whole, the Gaelic branch, the Irish and Scotch, seem to agree in stature, and to contrast alike with the

Brythonic branch of the Welsh and Cornish. It is permissible to suppose that the absence of contact implied by these ancient linguistic differences might allow of a separate modification of the Scottish wing to the end we have observed. At all events, we have laid bare



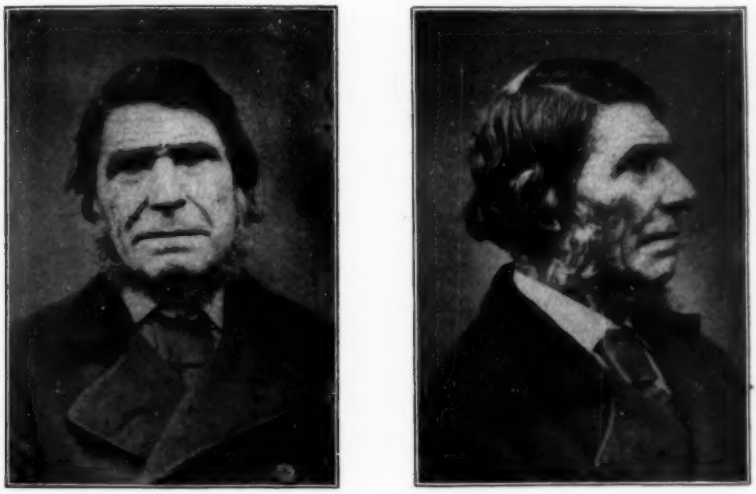
BLONDISH ANGLO-SAXON TYPES. Yorkshire.

the facts, even if we have pricked holes in the Iberian hypothesis thereby.

Enough portraits have now been presented to admit of a few hasty generalizations concerning the facial features peculiar to Britain. To be sure, all sorts of difficulties beset us at once. It is unfair to compare different ages, for example. The youthful countenance is less scarred by time. Nor, again, is it just to draw comparisons from different stations in life. In the same race the exposed farm laborer will differ from the well-fed and groomed country gentleman. Strongly marked racial differences between social classes exist all over the islands. The aristocracy everywhere tends toward the blond and tall type, as we should expect. We may, however, draw a few inferences from the data at our disposal, which seem to be well grounded in fact. The most peculiar characteristic of the Teutonic face, as a whole, is its smooth, almost soft, regularity. The lower jaw of the brunette and more primitive type is apt to be squarish and heavy, with the bony ridges above the eyes strongly pronounced. This latter trait appears in nearly all our portraits—Welsh, Scotch, or Irish. It is notable in the Cornishmen. In all cases this endows the features with a certain ruggedness and strength which is pleasing to the eye. Finally—for we have no space to enlarge upon the subject in this place—the nose in the Teuton is more

apt to be finely molded, thin, and straight. In the early British it is heavier, broad at the nostrils, and inclined to irregularity in profile. Facial peculiarities are, however, so open to modification by artificial selection that they are quite untrustworthy for purposes of racial identification by themselves alone. Only when combined with the more fundamental traits which we have already examined may we place confidence in their testimony.

A by no means negligible factor in the discussion as to the ethnic origin of the most primitive stratum of the populations of the British Isles is temperament. To treat of disposition thus as a racial characteristic is indeed to trench upon dangerous ground. Nevertheless, remembering how potent environment, social or material, may readily become in such matters; even the most superficial observer can not fail to notice the profound contrast which exists between the temperament of the Celtic-speaking and the Teutonic strains in these islands. These present almost the extremes of human development in such matters. They come to expression in every phase of religion or politics; they can no more mix than water and oil. The Irish and Welsh are as different from the stolid Englishman as indeed the Italian differs from the Swede. Far be it from us to



"Black Breed." Shetland Islands.

beg the question by implying necessarily any identity of origin by this comparison; yet we can not fail to call attention to these facts. There is some deep-founded reason for the utter irreconcilability of the Teutons and the so-called Celts. Our most staid and respectable commentators, the authors of the Crania Britannica, never weary of calling attention to it. Imagine an Englishman—choos-

ing one of their many examples of Welch characteristics—describing the emotional tumult of a marriage celebration by declaring that he "had never see sic a wedding before, it was just like a vuneral"!

The Welsh disposition or temperament is less familiar to us in America than the Irish; it is the exact counterpart of it. The keynote of this disposition lies in emotion. As vehement in speech as the Alpine Celt in Switzerland, France, or Germany is taciturn; as buoyant and lively in spirits as the Teutonic Englishman is reserved; the feelings rise quickly to expression, giving the power of eloquence or its degenerate prototype loquacity. This mental type is keen in perception, not eminent for reasoning qualities; "a quick genius," as Matthew Arnold puts it, "checkmated for want of strenuousness or else patience." As easily depressed as elated, this temperament often leads, as Barnard Davis says, to "a tumult followed by a state of collapse." Apt to fall into difficulty by reason of impetuousness, it is readily extricated through quick resourcefulness. In decision, leaning to the side of sentiment rather than reason, "always ready," in the words of Henri Martin, "to react against the despotism of fact." Compare such an emotional constitution with the heavy-minded, lumbering but substantial English type, and one realizes the possible "clashing of a quick perception with a Germanic instinct for going steadily along close to the ground." Ascribe it all to a difference of diet, if you please, as the late Mr. Buckle might have done; derive the emotional temperament from potatoes, and the stolid one from beef; or invent any other excuse you please, the contrast is a real one. It points vaguely in the direction of a Mediterranean blend in the Welsh and Irish, even to a lesser degree in the Highland Scotch. More we dare not affirm.

THE moderator of the recent General Assembly of the Free Church of Scotland, Dr. Hugh MacMillan, an eminent divine of undoubted orthodoxy, in his inaugural address before the assembly, said, alluding to scientific discoveries, that the scientific method had created a greater regard for truth than ever before existed in the world. The extraordinary exactness of the scientific method in the physical world has reacted beneficially upon the moral world, and has led to an intolerance of every form of falsehood. The scientific method is carried into theological studies, and men under its influence refuse to accept conventional or traditional evidence, and insist upon subjecting even the most sacred things to the most rigid investigation. Veracity is the passion of their life. In this way the influence of recent science in some directions and to some extent has been unsettling, but upon the whole it has been a great and permanent advantage. True religion can not possibly suffer from the tests and methods of science properly conducted.

ARE THERE PLANETS AMONG THE STARS?

By GARRETT P. SERVISS.

THIS always interesting question has lately been revived in a startling manner by discoveries that have seemed to reach almost deep enough to touch its solution. The following sentences, fresh from the pen of Dr. T. J. J. See, of the Lowell Observatory, are very significant from the point of view of our inquiry:

"Our observations during 1896–'97 have certainly disclosed stars more difficult than any which astronomers had seen before. Among these obscure objects about half a dozen are truly wonderful, in that they seem to be dark, almost black in color, and apparently are shining by a dull reflected light. It is unlikely that they will prove to be self-luminous. If they should turn out dark bodies in fact, shining only by the reflected light of the stars around which they revolve, we should have the first case of planets—dark bodies—noticed among the fixed stars."

Of course, Dr. See has no reference in this statement to the immense dark bodies which, in recent years, have been discovered by spectroscopic methods revolving around some of the visible stars, although invisible themselves. The obscure objects that he describes belong to a different class, and might be likened, except perhaps in magnitude, to the companion of Sirius, which, though a light-giving body, exhibits nevertheless a singular defect of luminosity in relation to its mass. Sirius has only twice the mass, but ten thousand times the luminosity, of its strange companion! Yet the latter is evidently rather a faint, or partially extinguished, sun than an opaque body shining only with light borrowed from its dazzling neighbor. The objects seen by Dr. See, on the contrary, are "apparently shining by a dull reflected light."

If, however (as he evidently thinks is probable), these objects should prove to be really non-luminous, it would not follow that they are to be regarded as more like the planets of the solar system than like the dark companions of certain other stars. A planet, in the sense which we attach to the word, can not be comparable in mass and size with the sun around which it revolves. The sun is a thousand times larger than the greatest of its attendant planets, Jupiter, and more than a million times larger than the earth. It is extremely doubtful whether the relation of sun and planet could exist between two bodies of anything like equal size, or even if one exceeded the other many times in magnitude. It is only when the difference is so great that the smaller of the two bodies is practically

insignificant in comparison with the larger, that the former could become a cool, life-bearing globe, nourished by the beneficent rays of its organic comrade and master.

Judged by our terrestrial experience, which is all we have to go by, the magnitude of a planet, if it is to bear life resembling that of the earth, is limited by other considerations. Even Jupiter, which, as far as our knowledge extends, represents the extreme limit of great planetary size, may be too large ever to become the abode of living beings of a high organization. The force of gravitation on the surface of Jupiter exceeds that on the earth's surface as 2.64 to 1. Considering the effects of this on the weight and motion of bodies, the density of the atmosphere, the laws of pneumatics, etc., it is evident that Jupiter would, to say the very least, be an exceedingly uncomfortable place of abode for beings resembling ourselves. But Jupiter, if it is ever to become a solid, rocky globe like ours, must shrink enormously in volume, since its density is only 0.24 as compared with the earth. Now, the surface gravity of a planet depends on its mass and its radius, being directly as the former and inversely as the square of the latter. But in shrinking Jupiter will lose none of its mass, although its radius will become much smaller. The force of gravity will consequently increase on its surface as the planet gets smaller and more dense.

The present mean diameter of Jupiter is 86,500 miles, while its mass exceeds that of the earth in the ratio of 316 to 1. Suppose Jupiter shrunk to three quarters of its present diameter, or 64,800 miles, then its surface gravity would exceed the earth's nearly five times. With one half its present diameter the surface gravity would become more than ten times that of the earth. On such a planet a man's bones would snap beneath his weight, even granting that he could remain upright at all! It would seem, then, that, unless we are to abandon terrestrial analogies altogether and "go it blind," we must set an upper limit to the magnitude of a habitable planet, and that Jupiter represents such upper limit, if, indeed, he does not transcend it.

The question then becomes, Can the faint objects seen by Dr. See and his fellow-observers, in the near neighborhood of certain stars, be planets in the sense just described, or are they necessarily far greater in magnitude than the largest planet, in the accepted sense of that word, which can be admitted into the category—viz., the planet Jupiter? This resolves itself into another question: At what distance would Jupiter be visible with a powerful telescope, supposing it to receive from a neighboring star an amount of illumination not less than that which it gets from the sun? To be sure, we do not know how far away the faint objects described by

Dr. See are; but, at any rate, we can safely assume that they are at the distance of the nearest stars, say somewhere about three hundred thousand times the earth's distance from the sun. The sun itself removed to that distance would appear to our eyes only as a star of the first magnitude. But Zöllner has shown that the sun exceeds Jupiter in brilliancy 5,472,000,000 times. Seen from equal distances, however, the ratio would be about 218,000,000 to 1. This would be the ratio of their light if both sun and Jupiter could be removed to about the distance of the nearest stars. Since the sun would then be only as bright as one of the stars of the first magnitude, and since Jupiter would be 218,000,000 times less brilliant, it is evident that the latter would not be visible at all. The faintest stars that the most powerful telescopes are able to show probably do not fall below the sixteenth or, at the most, the seventeenth magnitude. But a seventeenth-magnitude star is only between two and three million times fainter than the sun would appear at the distance above supposed, while, as we have seen, Jupiter would be more than two hundred million times fainter than the sun.

To put it in another way: Jupiter, at the distance of the nearest stars, would be not far from one hundred times less bright than the faintest star which the largest telescope is just able, under the most exquisite conditions, to glimpse. To see a star so faint as that would require an object-glass of a diameter half as great as the length of the tube of the Lick telescope, or say thirty feet!

Of course, Jupiter might be more brilliantly illuminated by a brighter star than the sun; but, granting that, it still would not be visible at such a distance, even if we neglect the well-known concealing or blinding effect of the rays of a bright star when the observer is trying to view a faint one close to it. Clearly, then, the obscure objects seen by Dr. See near some of the stars, if they really are bodies visible only by light reflected from their surfaces, must be enormously larger than the planet Jupiter, and can not, accordingly, be admitted into the category of planets proper, whatever else they may be.

Perhaps they are extreme cases of what we see in the system of Sirius—i. e., a brilliant star with a companion which has ceased to shine as a star while retaining its bulk. Such bodies may be called planets in that they only shine by reflected light, and that they are attached to a brilliant sun; but the part that they play in their systems is not strictly planetary. Owing to their great mass they bear such sway over their shining companions as none of our planets, nor all of them combined, can exercise; and for the same reason they can not, except in a dream, be imagined to possess that which, in our eyes, must always be the capital feature of a planet, rendering

it in the highest degree interesting wherever it may be found—sentient life.

It does not follow, however, that there are no real planetary bodies revolving around the stars. As Dr. See himself remarks, such insignificant bodies as our planets could not be seen at the distance of the fixed stars, "even if the power of our telescopes were increased a hundredfold, and consequently no such systems are *known*."

This brings me to another branch of the subject. In the same article from which I have already quoted (Recent Discoveries respecting the Origin of the Universe, Atlantic Monthly, vol. lxxx, pages 484-492), Dr. See sets forth the main results of his well-known studies on the origin of the double and multiple star systems. He finds that the stellar systems differ from the solar system markedly in two respects, which he thus describes:

"1. The orbits are highly eccentric; on the average, twelve times more elongated than those of the planets and satellites.

"2. The components of the stellar systems are frequently equal and always comparable in mass, whereas our satellites are insignificant compared to their planets, and the planets are equally small compared to the sun."

These peculiarities of the star systems Dr. See ascribes to the effect of "tidal friction," the double stars having had their birth through fission of original fluid masses (just as the moon, according to George Darwin's theory, was born from the earth), and the reaction of tidal friction having not only driven them gradually farther apart but rendered their orbits more and more eccentric. This manner of evolution of a stellar system Dr. See contrasts with Laplace's hypothesis of the origin of the planetary system through the successive separation of rings from the periphery of the contracting solar nebula, and the gradual breaking up of those rings and their aggregation into spherical masses or planets. While not denying that the process imagined by Laplace may have taken place in our system, he discovers no evidence of its occurrence among the double stars, and this leads him to the following statement, in which believers in the old theological doctrine that the earth is the sole center of mortal life and of divine care would have found much comfort:

"It is very singular that no visible system yet discerned has any resemblance to the orderly and beautiful system in which we live; and one is thus led to think that probably our system is unique in its character. At least it is unique among all *known* systems."

If we grant that the solar system is the only one in which small planets exist, revolving around their sun in nearly circular orbits, then indeed we should seem to have closed all the outer universe

against such beings as the inhabitants of the earth. Beyond the sun's domain only whirling stars, coupled in eccentric orbits; dark stars, some of them, but no planets; a wilderness, full of all energies except those of sentient life! This is not a pleasing picture, and I do not think we are driven to contemplate it. Beyond doubt, Dr. See is right in concluding that the double and multiple star systems, with their components all of magnitudes comparable among themselves, revolving in exceedingly eccentric orbits under the stress of their mutual gravitation, bear no resemblance to the orderly system of our sun with its attendant worlds. And it is not easy to imagine that the respective members of such systems could themselves be the centers of minor systems of planets, on account of the perturbing influences to which the orbits of such minor systems would be subjected.

But the double and multiple stars, numerous though they be, are outnumbered a hundred to one by the single stars which shine alone as our sun does. What reason can we have, then, for excluding these single stars, constituting as they do the vast majority of the celestial host, from a similarity to the sun in respect to the manner of their evolution from the original nebulous condition? These stars exhibit no companions, such planetary attendants as they may have lying, on account of their minuteness, far beyond the reach of our most powerful instruments. But since they vastly outnumber the binary and multiple systems, and since they resemble the sun in having no large attendants, should we be justified, after all, in regarding our system as "unique"? It is true we do not know, by visual evidence, that the single stars have planets, but we find planets attending the only representative of that class of stars that we are able to approach closely—the sun—and we know that the existence of those planets is no mere accident, but the result of the operation of physical laws which must hold good in every instance of nebular condensation.

Two different methods are presented in which a rotating and contracting nebula may shape itself into a stellar or planetary system. The first is that described by Laplace, and generally accepted as the probable manner of origin of the solar system—viz., the separation of rings from the condensing mass, and the subsequent transformation of the rings into planets. The planet Saturn is frequently referred to as an instance of the operation of this law, in which the evolution has been arrested after the separation of the rings, the latter having retained the ring form instead of breaking and collecting into globes, forming in this case rings of meteorites, and reminding us of the comparatively scattered ring of asteroids surrounding the sun between the orbits of Mars and Jupiter. This Laplacean process Dr.

See regards as theoretically possible, but apparently he thinks that if it took place it was confined to our system.

The other method is that of the separation of the original rotating mass into two nearly equal parts. The mechanical possibility of such a process has been proved, mathematically, by Poincaré and Darwin. This, Dr. See thinks, is the method which has prevailed among the stars, and prevailed to such a degree as to make the solar system, formed by the ring method, probably a unique phenomenon in the universe.

Is it not more probable that both methods have been in operation, and that, in fact, the ring method has operated more frequently than the other? If not, why do the single stars so enormously outnumber the double ones? It is of the essence of the fission process that the resulting masses should be comparable in size. If, then, that process has prevailed in the stellar universe to the practical exclusion of the other, there should be very few single stars; whereas, as a matter of fact, the immense majority of the stars are single. And, remembering that the sun viewed from stellar distances would appear unattended by subsidiary bodies, are we not justified in concluding that its origin is a type of the origin of the other single stars?

While it is, as I have remarked, of the essence of the fission process that the resulting parts of the divided mass should be comparable in magnitude, it is equally of the essence of the ring, or Laplace, process that the bodies separated from the original mass should be comparatively insignificant in magnitude.

As to the coexistence of the two processes, we have, perhaps, an example in the solar system itself. Darwin's demonstration of the possible birth of the moon from the earth, through fission and tidal friction, does not apply to the satellites attending the other planets. The moon is relatively a large body, comparable in that respect with the earth, while the satellites of Jupiter and Saturn, for instance, are relatively small. But in the case of Saturn there is visible evidence that the ring process of satellite formation has prevailed. The existing rings have not broken up, but their very existence is a testimony of the origin of the satellites exterior to them from other rings which did break up. Thus we need not go as far away as the stars in order to find instances illustrating both the methods of nebular evolution that we have been dealing with.

The conclusion, then, would seem to be that we should not be justified in assuming that the solar system is unique simply because it differs widely from the double and multiple star systems; and that we should rather regard it as probable that the vast multitude of stars which do not appear, when viewed with the telescope, or

studied by spectroscopic methods, to have any attendants comparable with themselves in magnitude, have originated in a manner like that of the sun, and may be the centers of true planetary systems resembling ours. The argument, I think, goes further than to show the mere possibility of the existence of such planetary systems surrounding the single stars. If those stars did not originate in a manner quite unlike the origin of the sun, then the existence of planets in their neighborhood is almost a foregone conclusion, for the sun could hardly have passed through the process of formation out of a rotating nebula without evolving planets during its contraction. And so, notwithstanding the eccentricities of the double stars, we may still cherish the belief that there are eyes to see and minds to think out in celestial space.

ANIMATED PICTURES.

By J. MILLER BARR.

A NEW and wonderful field in the realm of photography has lately been opened up to the world—a field whose extent, variety, and richness are as yet scarcely realized, though its assiduous cultivation by inventive minds has already afforded a harvest of interesting results.

The nature of this new domain is pointed out by the title of our present sketch. Aided by ingenious devices, the scientific photographers of to-day are enabled to portray motion in all its varied forms with a realism that impresses the beholder. They have, in effect, contrived to breathe life into normally changeless records of the camera; and the process is now applied, with marked success, to animated scenes of the most diverse description. The busy traffic of city streets, the play of expression upon the human countenance, the movements of waves, waterfalls, fleeting clouds—these and many other effects have been depicted upon the screen with equal fidelity before audiences that have seldom failed to show their appreciation of the novel form of entertainment thus provided.

It is true that these "motion views" are subject to certain imperfections. Apart from the flashing or pulsating effect * which distinguishes the pictures, there are frequent blemishes, arising in part from mechanical, in part from photographic and other causes.

* This effect can be got rid of only by considerably increasing the *rate per second* at which the individual pictures are shown. When, however, this rate is as high as forty or fifty per second of time, the light-pulsations are hardly noticeable, and can not be said to mar the pictures in any appreciable degree.

SECTION OF FILM (actual size).
A squad of soldiers at drill.

Chief among these causes must be mentioned the use of faulty apparatus and of films of inferior quality, or which have become worn by frequent and prolonged use. Minor blemishes are, however, of common occurrence, even when the best obtainable apparatus and materials are used for the purpose. These are referable chiefly to defects in the sensitized films of celluloid. But there is no reason to doubt that better films can be produced, and that pictures of this nature will ultimately be rendered as free from defects as are ordinary stereopticon views.

Meanwhile, these striking productions of the photographic art will doubtless continue to attract the world's attention. They have already become a source of much instructive entertainment to the public; and their usefulness, from this point of view, must be recognized by all. But the invention has other and more serious claims upon our consideration. As a means of permanently recording and vividly illustrating notable events its importance will scarcely be overestimated. The ordinary photography can depict for us only isolated phases in the varied phenomena of life or Nature; though the value of its precise records, from the historian's standpoint, has of course received ample recognition. But the charm of animation may henceforth be added to our portrayals of historic scenes. And, in like manner, we shall be enabled to record the mutable expressions, the gestures and mannerisms, as well as the features, of distinguished men and women; while the value of all such records must increase with the lapse of time. These aspects of our subject are, indeed, so attractive that one is tempted to dilate upon them at some length; but I shall content myself with a brief allusion to one recent event in which the whole world has evinced keen interest—viz., the

celebration of the Diamond Jubilee of Her Majesty Queen Victoria. The Royal procession and other imposing features of the jubilee ceremonials were duly recorded upon cinematographic films, of which fine specimens were set aside for future preservation in England's National Museum. These have been "hermetically sealed and deposited in the museum, together with a machine and lantern, by means of which they may be exhibited to future generations."

We can only strive to realize, in some dim measure, the fascination which those pictured ribbons of celluloid will exercise upon the eyes and minds of future Londoners—let us say, at some remote epoch, when the throne of Great Britain will be occupied by a monarch of whom we can form no conception, under social conditions which may differ widely from those existing at the present day.

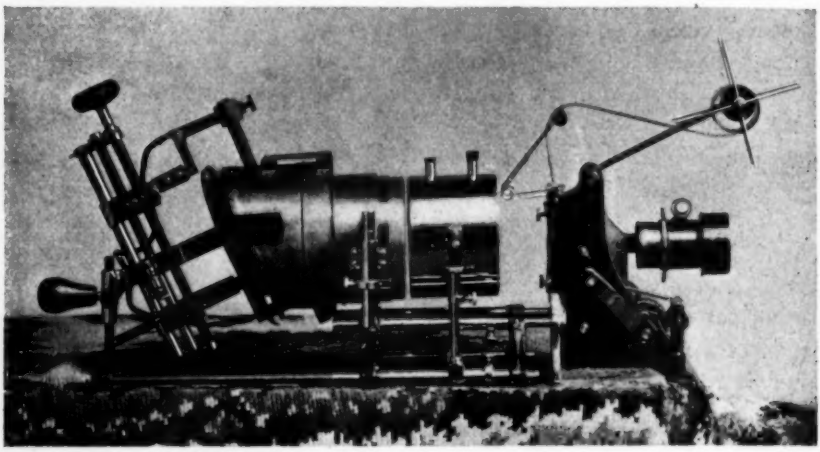
I have thus far alluded only to the more obvious uses of this beautiful invention. But the subject, as we shall presently see, may be regarded from two very distinct points of view. On the one hand, we are concerned with the ordinary animated pictures, whose properties and functions are already known to the public; on the other, we have to deal with movements *originally imperceptible to the eye*, but which can be rendered visible upon a screen if the slow-moving bodies are photographed under conditions described in a subsequent part of this article. Pictures of this kind may, for convenience, be spoken of as *motion views of the second type*. Such pictures have not, I think, been produced up to the present time. But this aspect of the subject, though hitherto neglected (if not wholly overlooked), is deeply interesting and merits the most careful investigation. It will, accordingly, engage our especial notice, though the reader will first be led to consider in a general way the methods and principles upon which depend the production of ordinary animated photographs.

Although the kinetoscope and cinematograph are regarded as distinctively modern contrivances, it should be borne in mind that they represent only the recent development of a principle that has long been familiar to students of optical science. They are the descendants, so to speak, of more primitive forms of apparatus, among which may be specially mentioned the zoetrope and the phenakistiscope. The latter instrument—an optical toy devised by the famous French physicist Plateau—merits particular notice, since it apparently represents the first stage in that process of evolution which has led up to the elaborate motion-picture machines of the present day.

Though differing much in the details of their construction, these various machines are designed to fulfill the same general purpose—

viz., the display in rapid sequence of a long series of photographs, which hence convey to the eye and brain the impression of a continuous and animated scene. In the kinetoscope the small pictures are viewed through an enlarging lens by reflected light, whereas in the cinematograph, phantascope, vitascope, etc., they are projected upon a screen—a plan that is obviously best suited to the requirements of a public exhibition.

A machine of the last-mentioned type may be shortly described as a stereopticon, combined with such mechanism as is requisite for the precise manipulation of the celluloid picture film.* When the



MACHINE FOR PROJECTING ANIMATED PICTURES ON THE SCREEN. The phantascope, latest model, being an attachment for a J. B. Colt & Co. electric lantern.

apparatus is set in motion the long band of celluloid passes quickly, though not continuously, behind the projecting lens, between spools or bobbins which revolve at a uniform rate. While thus passing from its original spool to the winding reel the film encounters certain pulleys and toothed rollers that serve to accurately direct its movements. Along its edges are numerous small perforations,† into which the teeth of the rollers fit with precision; and by this means the small transparencies are made to occupy exactly similar positions when their images are projected upon the canvas. As each picture in its turn attains this critical position, it is momentarily brought to

* See accompanying illustration of the phantascope. For this picture, and for the other photographs here reproduced, I am indebted to Mr. C. Francis Jenkins, of Washington, D. C., inventor of the phantascope, and the author of various notable improvements connected with this branch of photography.

† These small square holes—usually six or eight for each picture—are punched out with great precision by a machine made for the purpose. They insure correct register, not only in exhibiting but also in "printing" the photographs.

a standstill. At the same time a shutter * is opened and an image of the picture flashes for an instant upon the screen. The shutter is then quickly closed, the picture resuming its motion, while its successor in the series is brought into a similar fixed situation.

This temporary stoppage of the film (or rather of a portion thereof), as each picture attains its proper place behind the projecting lens, is a very essential feature of the process. It is effected by various ingenious devices, among which those of Acres, Edison, and the Lumière brothers are deserving of special notice. Without, however, attempting to describe these diverse forms of apparatus, I will try to indicate in general terms the means by which an intermittent motion of the film is secured. Let us assume that a picture has arrived at the fixed position already referred to. At the instant of its arrival, a portion of the film on the *preceding* side of the picture will be in an unstrained or slack condition. The "slack" is then taken up by a continuously moving sprocket pulley, whereupon a rod or roller is quickly brought to bear against the now tightened film, pressing it to one side and as quickly releasing it. By this movement the next picture is pulled into its fixed position, while the film is made taut (or nearly so) on the *following* side of this picture. These operations are repeated continuously until the entire film has passed through the holding device in rear of the lens. The process may be compared, in a general way, with the automatic feeding of a web of paper to an ordinary printing press.

A specially constructed camera is used in taking the negatives from which ultimately motion pictures are obtained. This camera is provided with mechanism generally similar to that employed in showing the photographs.† Indeed, the selfsame mechanism has frequently been used for both purposes. The picture roll is replaced by a reel of sensitized film, upon which the exposures are made in quick succession when the apparatus is set in motion. From twenty-five to fifty photographs are thus "laid on" in a second of time. The films range in length from fifty to two hundred feet, and contain when finished from eight hundred to more than three thousand tiny negatives.

After exposure the film is subjected to the usual photographic operations. These are, however, conducted with special arrangements, rendered necessary by the inordinate length of the film. The latter is subsequently made to pass, in contact with a second

* In some forms of apparatus, such as the vitascope and phantascope, the shutter is omitted. The intermittent motion of the film does not seem to mar the continuity of the pictures, which are also more fully illuminated in the absence of a shutter.

† The Jenkins camera (see illustration) forms an interesting exception to this general rule.

sensitized film, beneath an incandescent lamp, whereby the photographs are impressed or "printed" upon the sensitive surface. This second film in its turn is passed through the various photographic processes. When complete, it is wound upon a spool, and is then ready to be placed in the cinematograph or other machine used in exhibiting the pictures. Here, as already stated, the mechanical arrangements correspond to those employed in taking the negatives.

THE JENKINS CAMERA, with rotating system of lenses; capable, in sunlight, of taking one hundred pictures per second.

Thus the pictures, when displayed before an audience, are seen to flash out in the same rapid sequence in which the original scenes were presented to the "eye of the camera."

A homely illustration may aid the reader in arriving at a perfectly clear comprehension of this subject. Let us take the case of a man who is slowly walking past a high picket fence and gazing intently at some moving object on the other side of the fence. His view will be interrupted at regular intervals by the pickets as they successively encounter his line of sight. But if he proceed more quickly a seemingly continuous view of the object in question will be obtained, though rapid alternations in its *brightness* will be manifested. These effects are due to a well-known cause—viz., the persistence of luminous impressions upon the human retina. Thus, our observer's eye retains for a brief period its impression of each momentary glimpse that is afforded him under the conditions just described; and the successive visual images become merged into one

another, while the rapid fading of these retinal impressions gives rise to the pulsating effect that is familiar to everybody.

Now, the well-known optical phenomena which I have here attempted to describe are, in fact, closely analogous to those exhibited by the animated pictures.* In the former case we have to deal with a moving body; in the latter, with photographs of such bodies; and since the momentary images in the first-mentioned case are practically changeless, it is evident that a similar general effect must be produced upon the organ of vision.

We have hitherto been concerned with motion pictures of the ordinary type—those, namely, which reproduce with accuracy the movements of the original scenes. In order to secure this result it is essential that our pictures be "taken" and exhibited *at the same rate* per unit of time. Where this condition has not been fulfilled, it is manifest that the pictured objects must appear to move either quicker or more slowly than their originals. If the difference in rate be small, its results will hardly be noticeable; if large, a curious but awkward and unnatural effect will be produced.

Suppose now the mechanism of our camera to be altered in such wise that successive exposures may be made at relatively long intervals of time, while the duration of each exposure can be varied at will. With this end in view, the camera should be provided with clockwork capable of running for twenty-four hours continuously. Thus equipped, we should be ready to experiment on objects—such as growing plants—whose changes are of too gradual a nature to be perceived by the eye.

An ordinary house plant—let us say a geranium, abutilon, or hyacinth—would form an admirable subject for the purpose. The photographs might be taken under the electric light † at intervals of an hour or more, though plants of rapid growth (such as climbers) might well be photographed at much shorter intervals. As a uniform illumination is essential, it would be necessary to exclude daylight while taking the negatives. At night the light source could be maintained continuously—a condition which tends, as is well known, to stimulate the growth of plants. The experiments might extend over a period of weeks, or even of many months, according to the nature of the plant selected. But the resulting film, when placed in the cinematograph for exhibition, would be "reeled off"

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* The analogy will be rendered more exact if we assume that *one eye only* is used by our observer in viewing the moving object. Binocular vision would modify, to a perceptible extent, the appearances presented.

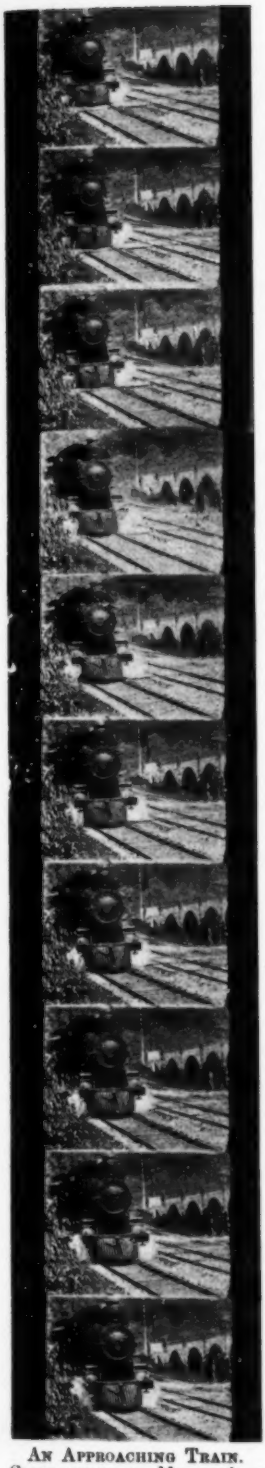
† An incandescent lamp would probably give the best results, though gas or oil flames could evidently be utilized.

in the course of a minute or two,* so that we should have, as it were, a greatly *magnified* representation of the movements involved in plant growth. If, for example, our pictures were taken at half-hourly intervals, and shown at a speed of fifty per second, the apparent rate of growth of the plant would be increased no less than ninety thousand times. A slower rate would evidently correspond to a diminished time interval between successive negatives; and this interval should in all cases be so chosen as to insure gradual (though distinctly perceptible) changes in the resulting pictures.

Such views could not fail to produce an effect at once marvelous, unique, and instructive. As pictured upon the canvas, the plants would grow and develop before the eyes of onlookers, throwing out leaf upon leaf, and visibly increasing their dimensions. Here and there a flower or flower cluster might make its appearance, the individual blossoms bursting forth suddenly and remaining visible for a brief period only. The process is clearly applicable to greenhouse or indoor plants of every description, from stately palms or tree ferns down to the most delicate mosses or lichens. Thus, the general phenomena of plant growth may be illustrated with a vividness never before realized. As object lessons in botany, such motion pictures would be invaluable, while the general public, not less than the advanced student of science, would regard them with feelings of the keenest interest.

Instead of photographing an entire plant, we might direct our efforts to the representation of its more interesting details. Thus, an expanding leaf bud or a flower stalk would furnish highly attractive views for the cinematograph. The microscope, too, could be brought to bear, and with its aid we should be enabled to depict the more delicate and subtle processes of vegetable growth. Such optical studies would be not merely instructive in the ordinary sense of that term, but they would be likely to throw new light on biological problems of the deepest interest. For we are here concerned with changes which can not be directly observed, and whose nature can only be imperfectly apprehended from a comparison of ordinary photographs taken for the purpose. We know, for example, that common instantaneous views of men or animals in motion convey a most imperfect idea of the *actual movements* involved in walking or running; and a similar remark would doubtless apply with greater force in cases where the pictured objects were undergoing changes of a complex physical nature; so that the human eye, aided by the sensation of motion, might well succeed in bringing to light laws or relations hitherto unrecognized by botanists.

* Although the motion views do not commonly endure beyond these limits, it should be noted that a much longer duration—involving the use of many films—is now practicable.



AN APPROACHING TRAIN.
Compare upper and lower views of the film.

This graphic method should theoretically be applicable to insects and animals as well as to plants. In practice, however, it can be successfully applied only to the lower and the higher forms of animal life. On the one hand, we could picture the growth of certain lowly organisms in the border land between the animal and vegetable worlds; on the other, we could portray the development of a child, or even the life changes of a human being from childhood to old age. Pictures of the latter class may evidently be taken at daily intervals; uniformity in position and expression, as well as in the clothing or drapery of the subject, being essential requisites to success in all such cases.

In dealing with subjects of this nature we must take into account the inevitable deterioration of the sensitive films through lapse of time. It will become necessary, in fact, to use *shorter* films whenever the negative series is much prolonged. Such films could be treated separately, and afterward joined together so as to form one long strip —a procedure involving only the exercise of a little care and the use of some celluloid solution. From this composite negative film a single uniform roll of pictures would ultimately be obtained by the usual process.

The application of this method to outdoor objects will in general be greatly restricted, owing in part to the variable light and partly also to the influence of wind and weather. Some picturesque effects could, however, be obtained by photographing natural scenery under varying angles of solar illumination—especially in mountainous regions and near the time of sunrise or sunset, when the most striking changes would be manifested. Seasonal variations, too, might be illustrated by depicting scenery in a forest from day to day for months in succession. Owing to the gradual nature of

such changes it would be practicable to take several negatives at about the same hour of each day, an actinometer being used, and the exposures varied in accordance with its indications. The operations might thus be omitted during bad weather, an additional number of photographs being taken on succeeding fine days. Some very pleasing views for the cinematograph could without doubt be obtained by this mode of procedure.

Turning now from the earth to the heavens, we shall see that similar methods are applicable to the most prominent of celestial bodies—viz., the sun. The photographic art has long since been applied with conspicuous success to the glowing solar disk, with its dark spots and brighter patches or "faculæ"; and such photographs are now taken from day to day at leading observatories in various parts of the globe. During recent years, moreover, astronomers have contrived to photograph, under ordinary conditions, the surroundings of the great luminary—including the chromosphere and prominences, but excepting the corona, which can not as yet be studied in the absence of an eclipse.

I shall not attempt to describe the many interesting features shown in such photographs; nor is it necessary in this place to indicate the precise means whereby solar picture films can be produced. The chief point to be noted is that changes—often of a rapid and striking character *—are continually occurring both in the sun's photosphere and its gaseous surroundings. The cinematograph will enable us to actually *see* such changes taking place; and it may be possible in this way to obtain new light on certain fascinating, though recondite, problems presented by the sun, while the complex solar movements may in any case be pictured in a manner that can not fail to prove deeply interesting and instructive.

Although the common motion views are often described as realistic, there are two respects in which they fail to correctly represent the original scenes. Not only do they lack the charm of color (which adds so much to the variety and interest of ordinary scenes), but the effect of solidity, due to our binocular vision, is also absent. As regards the reproduction of color, we shall have to rest content—at least for some time to come—with monochromic views of *ordinary* moving objects. Instantaneous photography in colors is not yet possible, nor is it likely to be achieved in the near future. In the color process of M. Lippmann, for example, it is necessary to expose the sensitive plates for relatively long periods of time. It may be questioned, also, whether such photographs could be successfully produced upon celluloid films. And even if these objections were re-

* We are here concerned with movements which, though invisible to the observer's eye, take place in reality with very great rapidity.

moved, there would remain another serious drawback—viz., that such pictures must be viewed by reflected light, and hence can not be projected upon a screen in the usual way.

But there are other methods of obtaining colored pictures which merit careful consideration from our present point of view.* One of these methods is so clearly applicable in the production of motion views of the second type that I need offer no apology for the brief account of it given below:

A camera fitted with special apparatus—including three carefully selected color screens—is used in taking the negatives. The arrangements are such that three separate images—red, blue, and green-yellow—of the scene or subject are thrown upon the sensitive (isochromatic) plate. The result is a triple negative, from which a transparency is obtained by the usual procedure. If now this transparency be placed in a lantern provided with a triple objective and with color screens similar to those used in taking the pictures, the three colored images of the transparency may be brought into coincidence upon the screen. And since the tints of the glasses correspond to the three primary color sensations, a picture in natural hues will be thus produced. The process, in its perfected form, is due to Mr. Frederic E. Ives, of Philadelphia, who has in this way been able to reproduce the colors of flowers and of natural scenery with complete success.

Now, there is no reason to doubt that similar results can be secured by using films instead of glass plates; so that Mr. Ives's ingenious system (or some modification thereof) may probably be adapted for use with mechanism similar to that of the cinematograph.

We may thus hope to obtain striking and beautiful representations of plant life, in which not only the forms and movements of leaves, stalks, or flowers, but also their glowing colors, will appear upon the canvas.

The realism of our motion pictures may also be enhanced by imparting to them the quality of relief, as in the stereoscope. We may utilize for this purpose a clever invention known as the lantern stereoscope,† whereby stereo views can be shown upon a screen, the pictures being viewed through instruments resembling opera glasses in external appearance. It will be possible in this way to exhibit animated views of every description in distinct stereoscopic relief. Each member of the audience must, of course, be provided with one of the binocular instruments above referred to; and it is almost need-

* It is too soon, as yet, to express any definite opinion with respect to the new Dansac process and some other heliochromic methods of recent origin.

† The principle of the polarization of light is effectively utilized in this very ingenious contrivance.

less to add that the projecting machine, as also the camera used in taking the stereo negatives, must be of duplicate construction.

The phonograph—or graphophone—has frequently been used in combination with machines for the production of motion views. By such means Edison hoped to reproduce the sounds accompanying many scenes with such perfection that it would be possible to represent, for example, the complete performance of an opera or a drama, with all its accessories. Up to the present time, however, these anticipations have not been realized. The rich song notes of a Patti or a Melba can not yet be satisfactorily stored up in the phonographic cylinder, to be given out when required with the full tone and perfect expression of the artist. But better things may be looked for in the near future, and it is probable that Edison's attractive scheme will, sooner or later, be carried into effect.

In an ideal exhibition of this nature we should see the animated views appear upon the screen in relief and in their natural tints, while the sounds appropriate to certain scenes would be reproduced with as much fidelity as the optical impressions. Much remains to be done before this ideal can be fully realized; but in the meantime it will be possible, with our present resources, to make some progress in this direction, and to obtain pictures of a novel and instructive type, by proceeding along the lines which I have attempted to define in the present article.

PROCESSES OF CHANGE IN PRONUNCIATION.*

By MICHEL BRÉAL,
PROFESSOR OF COMPARATIVE PHILOLOGY IN THE COLLÉGE DE FRANCE.

PROFESSOR OSTHOFF, of the University of Heidelberg, has said that phonetic laws are blind and operate with a blind necessity. If, instead of this, he had said that these laws are constant so long as they are the effect of our habits, and that our habits, where nothing contradicts them, are manifested uniformly and regularly, he would have uttered an incontestable truth. But we do not think they are fatal or blind.

Phonetic changes start from one person. If they are not accepted, they remain without effect and are soon forgotten.

At such an age as ours, with a settled tradition of pronunciation, with our schools and academies, the individual has little power. But it has not been so always and everywhere. Suppose that, among

* An address delivered at the institution of the Laboratory of Experimental Phonetics in connection with the Collége de France.

a barbarous people, a man of authority and influence, whether by physical defect or from some other cause, commits a fault in articulation. It is imitated, in the family first, and then among the relatives and neighbors. The peculiarity of pronunciation spreads, and is more marked as it spreads; and if nothing occurs to interfere with it, a phonetic change is accomplished. But is there anything fatal in that? The change is very like those which take place in costume, or armor, or in the house; a historic fact, having neither more nor less of the character of fatality than other historical facts. It is true that if we go back to the initial cause we find on final analysis a movement of the vocal organs; but in what act of our life are not our organs the final motive? To assume fatality, it would be necessary to suppose that on a certain day the organs of speech of all the individuals of a group should be modified in the same manner.

There is a reason why the phenomena of language should be specially subject to imitation. Being a medium of communication, it would lack its essential condition if it varied as between one person and another, and would lose its right to be. Hence the necessity of a uniform pronunciation. But this is clearly a matter of social necessity, not of a physical fatality.

A phonetic change may be adopted; or it may be rejected, after a longer or shorter struggle; for peoples are composed of individuals who are not all of the same age, or of the same sex, or of equal education or social position. In the sixteenth century the Parisians were agreed in pronouncing *s* as *r* and conversely *r* as *s; Paris* became *Pasis*, and *oiseau* (bird) became *oireau*. The poet Marot made this matter the subject of a satire. The usage was contested as a ridiculous affectation, and went out, but not without leaving vestiges. The thick utterance of the incredibles of the Directory is another example of a merely passing fashion.

These fluctuations explain the otherwise incomprehensible variations of geographical maps of dialects. If we make linguistic charts of France in the twelfth, thirteenth, fourteenth, and sixteenth centuries, we shall find boundaries changing, one province growing larger, another smaller, and reverse changes perhaps taking place in the following period. Revolutions occur much like those of political power, but the two do not always coincide.

Phonetic changes may therefore be tracked. The interchange of *s* and *r* is thus traced from its beginning in Roussillon northward through France, till it reached the Norman islands; a second substitution of Germanic consonants, which established a difference between High German on one side and Low Dutch, English, and Scandinavian on the other, passed from south to north to the fifty-first and fifty-second degrees of latitude. The fact is thus explained

that linguistic classifications are usually in harmony with geographical conditions. The Pushtu (Afghan language) forms a medium between the Indian and the Iranian; the Arcadian (ancient Greek), between the three Æolian dialects; the Greek, an intermediate point between the Persian and the European languages. The Sardinian is halfway between Italian and Spanish.*

There is no absolutely pure dialect. Every population is mixed, has relations with its neighbors, and receives immigrations from abroad. A nation is never isolated, or a province, or a village; but, on the other hand, the closer the boundaries are drawn up, the more frequent are the exterior relations, because the distances to be traversed are less and the means of making one's self understood are easier. Unity is not found even in the family, whose members are in contact with the outside world, but not all in the same way. And finally, when we come to the individual, we have unity of pronunciation and phonetics no more, for we do not speak or pronounce in the same way when we address a single one or many, when we are cool or under the control of passion, when in full vigor and freshness or at the end of a day's work. Nor do we do so when addressing a superior or an equal, for conversation is essentially a work of collaboration, and our interlocutor must have his part in it. We sometimes hear it said of some one that "he knows how to speak to a crowd." All these circumstances modify pronunciation.† The supposed phonetic purity of dialects will therefore have to be considered one of the fancies of linguistics.

The words of the same dialect do not all obey exactly the same phonetic laws. The matter is controlled in part by the principle of frequency. Words which we pronounce more frequently are by that very fact pronounced with greater facility; and pronouncing them more easily, we give less attention and effort to them. Examples of this effect of recurring use of words are furnished in the names of persons and places and in exclamations. Words become more subject to alteration as we pay less attention to the meaning of the different elements of which they are formed. As long as we perceive clearly the significance of the two parts of a compound, that compound remains intact. But from frequency relaxation of attention results, or rather the several parts cease to be distinct to the mind, and the whole takes on the value of a single sign, and phonetic alteration has free scope.

Agglutinative languages, like the Hungarian, are less exposed to alteration than inflectional languages, for each element has a distinct

* J. Schmidt, Vokalismus, ii, 182. Schuchhardt, Vulgär Latein.

† This is well understood in the theater, and we may learn much from actors on this subject.

value which remains present to the mind. It would be a mistake to judge of the perfection of a language by the degree to which it has preserved the constituent elements of its words. The language performs greater services the further it is removed from its primary origin. A word is most perfect when it has reached the condition of a simple sign, letting the idea be perceived clearly without obscurity or refraction. Under all these considerations the laws of phonetics are not blind. It may be remarked, for example, that substantives change more readily than adjectives, participles, or adverbs, because the substantive passes more promptly to the state of a simple sign.

It is affirmed by M. Brugmann that the change in pronunciation starts in the organs before it affects the words; but we can not accept it except in pathological cases. A child born with defective organs will hear and pronounce particular sounds wrong; but this fault, recognized as arising from some deficiency of conformation, has no influence on the development of the language. No matter whether it is corrected or not, nobody imitates it. Minute changes, on the contrary, which in the beginning modify the articulations so slightly that their influence can hardly be perceived, are the important ones, because they are contagious and keep growing larger. It is by changes of this kind, continuing and increasing from generation to generation, that words become shortened, syllables and letters are lost out of them, and the pronounced word becomes so different from the spelled one as to excite remark. In nothing else do we find better illustrated what a modern writer calls the little forces—forces which in the course of ages have differentiated the words of half a dozen languages from their native origins, and have marked the distinctions between the Germanic tongues.

If these changes originated primarily in modifications of the organs, the sounds undergoing the transformations would disappear from the language. Yet we find that the same sounds which are regularly transformed in a larger proportion of words are still maintained in some. Hence the cause of the changes can not be found in modifications of the organs. We still pronounce *k* in the same way and with the same organs as in the Roman period, although in many of the words in which it once figured it has become *ch*.

We may obtain some light as to the origin of these phonetic changes by studying a similar phenomenon in writing. The hieroglyphics on the earliest Egyptian monuments are veritable drawings of definite objects. The same signs are found on more recent monuments, but traced as in a current hand, in which the engraver or scribe only indicated the contours. It is very evident that the hand of the scribes had undergone no modification, and that their

sight had not changed. Still less had the hieroglyphics gone out of use. The real and only cause of change was that the minds of the people had with the lapse of time become more accustomed to these characters, and that an abridged indication of them was sufficient to make them legible. It was therefore unnecessary to reproduce the detail of the figures, and all that was not essential was omitted. If the line of characters always presented an identical text, one of those unvarying formulas found in all languages, the abbreviations of the design would be still bolder. The hand and the eyes could easily run over these lines, the contents of which were known in advance.

The prime cause of phonetic changes is therefore mental. The word is a sort of vocal image impressed in the memory, the more or less complete reproduction of which is committed to our organs. The mind gradually familiarizes itself with this image, and no longer takes the same pains in reproducing it accurately, for it is sure of being understood. The will ceasing to watch over the organs, they follow their propensities. But if exactness becomes necessary, a slight effort of will is effective, the old consonants appear again, the contracted syllables resume their places, and we hear the word in its primary integrity.

While we have drawn our comparison from hieroglyphics, any movement directed by the will might have furnished a similar analogy. If we make the same gesture twenty times in succession, it will probably be less marked the twentieth time than the first.

Passing from one insensible change to another, it may happen that some sounds will quite disappear from the language, as has occurred, for example, with the liquid *l* in Zend, where it has been absorbed in *r*. If the organs in such cases seem incapable, it is not because they are different, but because they lack practice. If a Parisian youth is trained by an English governess, he runs the risk of having an English accent in speaking French. This does not prove that the conformation of his organs is peculiar, but that language has as much to do with making the organs as they with making language.

A third axiom is that the scale of sounds is never returned upon; that is, that when an articulation is once modified, it is never restored in its primitive purity. The habit of the Latin language is to contract its words; but *domnus* is at least as old as *dominus*, *Hercles* as *Hercules*, and *valde* as *validus;* and in inscriptions of the time of the empire, we find *discipulina* for *disciplina*, *tempuli* for *templi*, and *liberitas* for *libertas*. Change of *s* into *r* is one of the most general rules of Latin. But this change could not impose itself upon certain proper names, which fidelity or the taste for archaism

maintained in their primitive form (*Numisii*, *Papisii*, *Fusii*). Speaking metaphorically, we might say that people avoided pronouncing these names in the same free-and-easy manner as the rest of the language. The law of substitution of Germanic consonants, which is usually taken as the type and model of phonetic laws, presents occasional examples of sounds returned upon. It would, however, be in our opinion a mistake to offer the substitution of the Germanic consonants as a fact that was accomplished at a given moment in the history of the Indo-European languages, and the direction of which can be fixed within the limits of two dates. Substitutions were going on all through the middle ages, as is shown by the manner in which Latin words are written in German, and is still going on, as may be perceived when a Bavarian or a man of Würtemberg talks French. Accustomed by the usage of their own language to a certain way of pronouncing the explosives, they carry the habit everywhere.

As to the origin of this phenomenon, it is hardly credible that a population should have agreed to disfigure the sounds of their language by substituting, according to their whim, hard sounds for soft, aspirates for hard sounds, and soft sounds for aspirates. It is easier to comprehend that an alien people, adopting an Indo-European language, should have brought to it the habits of its native pronunciation. A second substitution of consonants, which proceeded from the south of Germany northward, corresponds probably with a new afflux of foreign population, which, bringing similar habits of pronunciation to an idiom already once transposed, displaced the consonants in a new degree, but still in the same direction. The difference between the High German and the Low German and Scandinavian idioms may be explained in some such way as this.

A fourth and last principle of phonetic changes is that they are effected according to the law of least effort. In view of the causes already considered, the tendency of language is to economize effort, and consequently to replace sounds that exact some degree of energy with weaker sounds. Thus the Latin labials *p* and *b* become *v* in French; some letters cease to be pronounced; and assimilations take place in groups of consonants. If we should listen to a Roman of the second or third century from the foundation of the city, we should probably be surprised at the energy of his pronunciation and the intensity of his articulations. Yet it would be incorrect to take this as a constant rule. The shortening and the softening down of words do not always result in diminution of effort. New groups of consonants are formed in the course of changes, which do not require less expenditure, but sometimes more. Reduction of time is thus often attained at the cost of increase of effort.

Among other observations which escape the ordinary rules of assimilation or weakening are those lately studied in the book of Meringer and Meyer on Faults of Speech, in the shape of metatheses, contaminations, articulations, etc., one class of which consists in the interchange of consonants by shifting them from the syllables to which they belong to others, so that the displaced consonant takes the position of the one that has displaced it. Such steps taking place in an idiom without literature or education are as contagious as the others. It is in this way that the root *spek*, which gives the Latin *spectare* and the Sanskrit *spak*, is in Greek σκεπ, whence σκέπτομαι, σκοπός, σκοπέω), and in French the Latin *scintilla*, which should make *échintelle*, has given *étincelle*. The vocal image has been reversed.

In the laboratory of experimental linguistics which has been instituted in this college, these phenomena of phonetics will be subjected to a scientific study, the articulations of individuals will be examined at the moment they are made in the mouth; and by means of the instruments of Edison and Marey we shall be able to write the sounds, or rather they will write themselves, so that they will offer to the minute and protracted observation of the eye what the ear necessarily perceived in a confused and fugitive way; and thus a whole order of research and discovery is opened to linguists, however little taste they may have for physics and the natural sciences.—*Translated for the Popular Science Monthly from the Revue Scientifique.*

In a book recently brought to light, *De Naturis Rerum*, or Concerning the Nature of Things, by one Neckham, who was some time in the late twelfth or early thirteenth century a professor in the University of Paris, the game of chess is treated entirely as a military diversion. The actions of the several pieces are compared to the military deeds of the heroes of old or to strategical devices in war. There are other evidences that it was played in Europe ordinarily or chiefly by soldiers. Among them is the presence of the chess rook (castle) in the coats of arms of twenty-six English families. It was discouraged by ecclesiastics about Neckham's time as a vanity and source of quarrels. One council, in fact, went so far as to order clerks excommunicated who indulged in it. For the same reasons John Huss is said to have deplored that he ever learned it. Neckham's account of the game includes a story of Louis the Fat, of France, who, when fleeing from Henry I, of England, killed a soldier who had caught his horse by the reins, saying that the king could never be taken, even in chess; and tells of several sanguinary feuds, with the loss of many lives, being occasioned by Reginald Fitz Ayman slaying a nobleman in Charlemagne's palace with a chessman. Neckham's book is a very curious one, covering most of the lore of his time, and treats of poetry, biblical criticism, astronomy, popular myths, birds, fishes, the structure of the earth, trees, compasses, fountains, animals, and many other subjects.

PRINCIPLES OF TAXATION.

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XIII.—THE EXISTING METHODS OF TAXATION.

(*Continued from page 17.*)

DISTINCTION BETWEEN "REAL" AND "PERSONAL" PROPERTY ARTIFICIAL AND NOT NATURAL.—As a further help to the understanding of the subject, it is important to here call attention to the circumstance that the distinction between real and personal property is, to a very great extent, an artificial and not a natural one, and that there is not only no common or accepted rule for their definition and distinction, but, on the contrary, a great diversity of statute enactment by the different States of the Federal Union and by foreign governments on the subject. (For abundant illustrations in proof of this statement, see Popular Science Monthly, vol. li, No. 5, pages 607, 609.) "The statute laws on the subject of taxation in the United States," says Mr. Hillard, in his Law of Taxation, "is as voluminous as the constitutional provisions are few and concise." With a general similarity, the laws of the different States are very diverse; and so numerous and frequent are the changes that the author disclaims any responsibility in his book for the implied statement that "the law of any particular State, however recent, is now in force."

The attempt, therefore, to recognize in a system of laws a distinction in respect to the so-called personal property that is perfectly arbitrary, and which forty-eight sovereign States of the Federal Union may alter at pleasure, is very likely to give a general result somewhat akin to that obtained by an artist who, in painting a landscape, selected a cow as his fixed point of perspective. If the cow had remained quiet, the picture might have been satisfactory; but as the cow walked off, the details of the picture were not harmonious.

VALUE RELATIONS OF LAND AND PRODUCTIVE CAPITAL.—One curious phenomenon attending the remarkable changes that have taken place within the last half century in the conditions of production and distribution of wealth, has been the more rapid increase in all countries of high civilization of that portion of their national wealth represented by the so-called personal property than in that portion represented by the value of land. Thus, in Great Britain, at the commencement of the present century, the value of land was believed to represent about forty per cent of the aggregate wealth or property of the kingdom. At the present time it probably does

not represent more than twenty-five per cent of such aggregate. In the United States the increase in recent years of personal property has been so remarkable as to entitle it to be regarded as phenomenal; and it can not be doubted that in highly civilized and densely populated States, like New York, Massachusetts, Rhode Island, etc., the aggregate of property classed as "personal" is greater in actual value than the aggregate of "real" property. In the great American cities the value of personal property probably closely approximates the English proportion. A recent report of the Boston Business Association expresses an opinion that the value of the personal property of that city is three or four fold that of its realty! And yet the amount of personal property made available for tax assessments shows everywhere a remarkable decrease; and this, notwithstanding a great concurrent increase in population and in the assessed value of real estate. It may also be regarded almost an economic axiom, that universally the market value of the aggregate of land and that of the aggregate of other productive capital are equal; and for the reason that the market value of land is merely the reflection of the value of the productive capital placed upon it and its immediate vicinity. It would therefore seem to be certain that the decline in the valuations of personal property, above noted, is not real, but simply represents the failure and utter inefficiency of the existing laws which have been enacted with a view of assessing and collecting taxes upon such property.

The following are some of the most striking illustrations of the decline of tax valuations of personal property in recent years in the United States: Thus, in 1866, the valuation of the city of Cincinnati, Ohio, for purposes of taxation was, *realty* $66,454,602, *personalty* $67,218,101. In 1892—twenty-six years after—the tax valuation of the real estate of the city was $144,708,810, while its personal property had decreased to $44,735,670; or, in other words, while the personal property of Cincinnati returned for taxation in 1866 was greater than the returned amount of real estate, the amount returned in 1892 was only about a quarter as much as the real estate; and yet during this quarter of a century the city of Cincinnati nearly doubled its population, and undoubtedly increased its wealth in a far greater proportion. In the city of Boston the value of the realty returned for taxation in 1868 was $287,635,800, and of personalty $205,937,300. In 1890 the corresponding figures were, realty $619,990,275, personalty $202,051,525, a disproportionate gain of realty of $417,938,750.

In the State of Massachusetts in 1862 personalty was assessed at $309,000,000 to $552,000,000 of real estate, or in the ratio of fifty-six per cent of the latter. In 1891 the personalty was $556,-

000,000 to $1,679,000,000 of real estate, or in the ratio of thirty-three and a third per cent. That is, the personalty of the State in twenty-nine years increased only $247,000,000, while the real estate increased $1,127,000,000, or nearly five times as much in the same time. "This simply means that more and more personal property, under the rigid tax system of Massachusetts, escapes taxation. The real estate can not have increased in value without an increase in personal wealth with which to increase the demand for it. Real estate does not make a demand for itself." In 1870 the personal property of the entire State of Massachusetts returned for taxation represented an average of $345 *per capita.*

It will be noted that the above exhibits represent the lengthened experience of the two States which adhere most closely to the infinitesimal theory of taxation; have a system of most comprehensive and explicit laws, framed by officials and enacted by legislators who believe in their theory, and a system of arbitrary administration that finds no parallel, except in thoroughly despotic countries, and is wholly antagonistic to the principles of a free government.

The experience of other States, where, under substantially the same provision for the taxation of personal property, the administration is less rigorous, is also most instructive.

In Jersey City, N. J., the tax valuation in 1892 of realty was $78,176,000, and of personalty $6,539,750. In 1870 the valuation of realty in the city of Brooklyn, N. Y., was $183,689,000, and of personalty $17,559,980. In 1893 the corresponding valuations were $486,497,000 realty, $17,559,000 personalty; and of the latter only $7,078,000 was assessed against individuals, the remainder being property of banks and corporations. Of the entire property of Brooklyn taken cognizance of by its tax officials in 1893, only 1.35 per cent of the whole was personalty proper.

In 1870 the entire value of the personalty of the city of New York, including bonds, jewels, pictures, furniture, bric-a-brac, etc., was put down by its assessors for taxation at $281,142,696; in 1893 the corresponding valuation was $370,936,000, of which less than half was personal estate proper, the remainder being various forms of corporate property, although it is reasonably certain that less than twenty men, residents of the city, held personal property in excess of this amount.

In 1870 the personal property of the entire State of New York returned for taxation represented an average of $99.13 *per capita.* In 1893 this average had fallen to $68.75 *per capita.* In Connecticut, in 1855, as before shown, State stocks, railroad, city, and other bonds, and money at interest constituted about ten per cent of the aggregate assessed valuation of property of the State. In 1885 the

corresponding proportion for taxation was three and three fourths per cent.

Similar illustrations drawn from the recent tax experiences of nearly every State in the Union might be indefinitely multiplied, and in the most western States of the Union, where the communities are mainly agricultural, the opinion of officials is also to the effect that personal property, as a rule, exceeds realty, and to a great extent escapes assessment and taxation.

Another curious and interesting feature of the situation is that in all those States where the most minute and thorough system of questioning with respect to the ownership of personal property prevails, investigation shows that, notwithstanding the acknowledged great increase in wealth in the form of personal property in recent years, the skill of its owners in concealing it has grown more rapidly; or, in other words, in every State in which a vigorous attempt has been made to reach and assess all the personal property of its citizens, a smaller percentage of such property is taxed to-day than was effected under operation of laws a quarter of a century ago.

Results of Recent Administrative Experiences.—A notice of some comparatively recent administrative experiences in attempting to successfully enforce taxation of personal property is especially pertinent at this point.

In 1879 California proposed a new Constitution. It was drafted in accordance with what was supposed to be the interest of the agricultural voters of the State, and was by them ratified, the merchants, commercial and financial interests being almost unanimously arrayed in opposition and voting against it. Under this Constitution and the laws made in pursuance of it, the results have been thus summarized: "Not only were bonds, money, and credits taxable, without any deduction on account of debts, except from credits, and then only such debts as were due to residents of the State of California, but holders of stock in corporations were avowedly and intentionally subjected to double taxation; first, upon the corporate property, and again upon the capital stock, which is merely their evidence of title to that property. It was supposed, alike by the friends and enemies of the new Constitution, that under its operation personal property of every description would be thoroughly reached, and at any rate that whatever was by any chance overlooked would be more than made up by double taxation upon that which was found. The actual result has been to falsify all the predictions of both the friends and enemies of the Constitution—for it has done no good, and very little harm, except in promoting fraud—for the reason that the capacity of the patriotic taxpayer to commit perjury and the susceptibility of assess-

ors to bribery have been altogether underestimated." Some of the results have been positively ludicrous.

"If the assessment returns are to be believed, in nine tenths of California there is not a pound of butter; in four fifths of the State the sheep do not produce any wool; fifty counties have quantities of beehives, but only four have any honey; personal property is vanishing from San Francisco; loans of money are becoming unknown in the rest of the State; bonds of cities and municipalities of all kinds are not held within the State to an amount equal to one sixth of the county bonds outstanding alone; and, finally, money has been smitten by a pestilence, two thirds of all that there was before the adoption of the Constitution having already taken to itself wings, and the remainder being evidently on the way. One of the great objects of the new Constitution was to tax railroad, telegraph, and telephone companies to the last cent of their value. The actual result has been that telegraph and telephone companies are now assessed for the cost of less than their bare poles, or about sixty-five dollars per mile. The railroad companies resisted taxation for one or two years, at the end of which, by a singularly simultaneous impulse of virtue, some thirty boards of supervisors directed their district attorneys rigorously to prosecute the railroad companies to the uttermost of the law. Thirty district attorneys forthwith hauled the railroad companies before the magistrates of justice. With equal promptness the thirty boards of supervisors met, and, without any consultation with each other, passed resolutions directing the district attorneys to compromise all suits at sixty per cent of the amount claimed; and the thirty district attorneys obeyed before the State officers could put in a protest."

It was anticipated that the new order of things would increase the burden of taxation on the city of San Francisco, and especially on personal property and money at interest. What actually happened is shown by the following figures: In 1880, before the new laws became operative, the city of San Francisco paid taxes on a valuation of $68,586,000 of personal property not money, and on $19,747,000 of money at interest or otherwise. In 1886, after the law had been operative for five years, it paid on a valuation of $48,705,000 of personal property, a decline of one third, and $6,188,000 of money, a decline of two thirds. In 1894, after the law had been in operation for fourteen years, it paid on a valuation of $56,130,000 of personal property, a decline of $12,454,000, and $7,100,000 of money at interest, a decline of $12,647,000.

It was naturally supposed that the new Constitution would have great influence in increasing the assessment of personal property in the form of tangible, visible merchandise, and of bonds and credits.

But the assessors of San Francisco found less of merchandise to tax in 1886 in that city than they did in 1880; and less in 1894 than they did in 1880, while the value of bonds returned by its citizens declined from $2,311,000 in 1880 to $449,000 in 1886. The total increase in the valuation of merchandise for bonds and credits for taxation in the fourteen years from 1875 to 1889 was less than one per cent.

The most recent, important, and incontrovertible record, however, of administrative experiences on this subject is to be found in the report of a tax commission authorized by the Legislature of Ohio, composed of four eminently qualified citizens—two Republicans and two Democrats—and presented to the Governor of that State in December, 1893. It is no exaggeration to say that, since the days of the French monarchy under Louis XVI, no report has been or could be made more discreditable to the people of any country claiming to be civilized, honest, and law-abiding.

The report first shows that Ohio has "the most efficient and minute scheme" of listing in duplicate "all classes of property"—dogs specially included—"which has been devised in any State." "Every citizen is bound under oath to make a complete return of his property," embracing all forms of personalty. "If he declines to make the oath required by law, a penalty of fifty per cent is added." This listing system in Ohio is characterized by the commission as like "the assessment list used in Germany in mediæval times (1531)," which it further asserts "has been abandoned everywhere inEurope." The statute provides that a designated official "may through the probate court call before him the citizen and examine him if he suspects that the return is not a complete one"; and in addition to all this the law empowers each county to contract with such persons—"tax inquisitors"—who may give information as to any personal property that has been "improperly withheld from the returns"; and who shall be "rewarded" to the extent of twenty per cent of the amount of tax "recovered through their efforts."

From a large amount of evidence collected by the commissioners and officially published by the State, the following selections illustrate the efficacy and workings of this system and its statutes:

For the year 1891 the gross amount of revenue collected in the whole State of Ohio through the operation of the tax inquisitorial law was about $750,000, or about two per cent of the entire taxes of the State. For the nine years from 1885 to 1893 inclusive, during which time this act was operative in Hamilton County, which is mainly the great and rich city of Cincinnati, the whole amount of taxes paid by its citizens was about $50,000,000, of which less than

$400,000 accrued through the operation of this agency. It is probable, however, that through its moral influence the taxpayers were induced to make larger returns of personal property than they would otherwise do. On the other hand, the commission report as a general effect of the "tax inquisitor law" in city counties that when a man of large wealth is made to pay through its agency he leaves the State; but in the country counties, as the man of means is not able to sell his property and remove from the State, he is forced to remain and pay the tax.

Again, the laws of Ohio require that all moneys owned by its citizens shall be annually returned for taxation. For the whole State the tax commission reports that there was on deposit in the year 1892 to the credit of individuals in national, State, and private banks, and exclusive of moneys redeposited by one bank with others, at least $190,000,000, "and probably a much larger amount." Of this $190,000,000, there was returned in 1893 for taxation a little over $38,000,000. In connection with this experience the commission calls attention to the following other extremely significant facts: "Of this estimate of $190,000,000, about $128,000,000 was deposited in the banks of the five counties containing the cities of Cincinnati, Toledo, Cleveland, Dayton, and Columbus. These same counties, however, returned for taxation only $6,088,096, while the remainder of the State, having about $70,000,000 in bank deposits, returned over $32,000,000." In the spring of 1892 there were on deposit in the various banks (national, State, and savings) of the city of Cleveland about $63,000,000. Of this money there was returned for taxation in that same year only $1,800,593; and about half of this sum was derived from the townships outside of the city."

The final conclusions of the commission were that "while in the country counties" (of Ohio), "where the assessor is personally acquainted with the circumstances of the taxpayer, and knows his wealth, the taxation of intangible property is perhaps feasible, it is in the city counties an utter failure. The general property tax has become in the city counties" (of the State), "to a very considerable extent, a tax upon tangible property only; and that no appreciable part of the intangible property existing in the city counties is reached by our method of taxation."

The net result of all the comparisons made by the Ohio commissioners between city and farming districts finally goes to prove that *the tax upon personal property makes farmers pay from four dollars to seven dollars where it makes the residents of large cities pay one dollar.*

Speaking generally of the effect of this Ohio scheme of taxation the commission further says:

"The system as it is actually administered results in debauching the moral sense. It is a school of perjury. It sends large amounts of property into hiding. It drives capital in large quantities from the State. Worst of all, it imposes unjust burdens upon various classes in the community: upon the farmer in the country, all of whose property is taxed because it is tangible; upon the man who is scrupulously honest; and upon the guardian, executor, and trustee, whose accounts are matters of public record. These burdens are unjust because by the system as administered these people pay the taxes which should be paid by their neighbors." And the commissioners finally add that "these conclusions are in accord with all current authorities on the subject."

That this claim of accordance on the part of the Ohio commissioners is fully warranted, attention is next asked to the conclusions of other State commissions which within a comparatively recent period have also officially investigated and reported upon this subject. Thus, a tax commission of New Hampshire in 1876, after recognizing the inefficiency of the existing laws for the taxation of personal property and "their corrupting and demoralizing influences," "frankly admit that they are unable to frame any law to which a free people would submit, or should be asked to submit, that will bring this class of property under actual assessment more effectually than it now is." An Illinois commission in 1886 asserted that the existing system "is debauching to the conscience and subversive of the public morals—a school for perjury, promoted by law." A Connecticut commission in 1887 reported that "the results of an investigation of nearly three years into the workings of our tax system have brought us to the conclusion that all items of intangible property ought to be struck out of the list. As the law stands it may be a burden upon the conscience of many, but it is a burden on the property of the few, not because there are few who ought to pay, but because there are few who can be made to pay." A West Virginia commission in 1884 asserted that "the payment of the tax on personalty" (in the State) "is almost as voluntary, and is considered pretty much in the same light, as donations to the neighboring church or a Sunday school."

In Massachusetts, where the law admits no offset of debts against visible and tangible property, and is regarded as complete, and where its execution is acknowledged to be most arbitrary and inquisitorial—some towns publishing each year every known item of each man's personal property, even down to the family pig and a string of sleigh bells—the most intelligent officials admit that their system is a comparative failure; and almost a complete failure as to reaching evidences of indebtedness, which, as before shown, constitute in

modern times so large a part of the personal property of every civilized community.

In the State of New York, where the letter of the tax laws in respect to the subjects of taxation is nearly the same as in Massachusetts and Ohio, but the administration less stringent, and where the aggregate of personal property nearly or fully equals in value the aggregate of real property, the proportion of the former returned for taxation is not in excess of one fifth of the total assessed valuation; while in the great city of New York, with a population of over a million, not one per cent of her citizens stand upon the books of the assessors as possessing any personal property subject to taxation other than shares in banking institutions.

In Wisconsin the State appears to have drifted into the same condition of things as in New York, and the attempt to tax personal property has been practically abandoned, except in the small villages and rural districts. In Georgia, which is reported to be well served by its taxing officials, its comptroller asserts that in respect to the mere article of merchandise which can be seen and handled, not fifty per cent is returned for taxation, and that in the city of Savannah in 1886 not ten watches were subjected to taxation.

To complete this record of experience it is desirable to add that there is not a single economist or financier of note, either in the United States or Europe, who upholds the "infinitesimal" or "general property" tax as a desirable or essential feature of any fiscal system, its characterization by M. Leroy-Beaulieu, the celebrated French economist, being that "a cruder instrumentality of taxation has rarely been devised."

Again, in every country on the globe where a direct tax on personal property in the hands of individuals has been laid, the system has exhibited the same features of badness. No experience in any country has suggested any practical improvements of it. It has never been improved; it has never grown better; it has always, under all circumstances, exhibited a tendency to grow worse. It is a fact creditable to the superior intelligence of other lands that it no longer is found in any civilized country on the globe, the United States alone excepted; and in this country it is no longer found in Pennsylvania, New Jersey, and perhaps some other States.

Prof. E. A. R. Seligman, of Columbia University, who has written much on this subject, sums up the result of his investigations in the following language: "It will be no exaggeration to say that the general property tax in the United States is a dismal failure. Every country also, with the exception of Holland and the States of the Federal Union, has abandoned this system of tax as something wholly impractical. In recent years in both England and France

the necessity of raising increased revenues has drawn especial attention to the subject of local taxation; but in neither of these two countries has any prominent speaker or writer advocated the direct taxation of personal property, or even alluded to the subject, except to scout the very idea of such a proposition." *

And yet, notwithstanding this record of disastrous and discreditable experience, and the opposition to the almost unanimous judgment of all whose investigations warrant the expression of opinion, the strength of popular prejudice in the United States in favor of the infinitesimal system of taxation is so great as to make the substitution of any better system a matter of very great difficulty, and perhaps a present impossibility. "Although all Europe, as already pointed out, has tried and discarded taxation of personal property, our own people have grown up under the opposite system. Every State tries to tax it. No American has any personal experience of a system which does not pretend to tax it. The proposition to dispense with such taxation, therefore, strikes every American as an experiment. Few Americans know or care anything about the experience of other nations."

There is, however, at the present time, some gratifying evidence of a change in popular sentiment in favor of radical tax reforms. Thus, in October, 1897, the grand jury of the county of New York made a presentment on the subject of taxation under the following circumstances: A complaint was made against the tax officials, charging undervaluations of property, and therefore perjury, but the grand jury finds in effect that the State laws are of such a character that assessors are almost inevitably led into blunders, and it recommends a general revision of the tax laws imposing upon the State the duty of assessing personal property, so that local expenditure may be paid by real-estate taxes alone, and the "question of continuing or abolishing personal taxes" be "fought out on State lines."

A special tax commission, appointed by the Governor of Massachusetts, and composed of men of wide financial experience and business ability, after careful study of this subject, reported in October, 1897, in favor of the entire exemption of personal property

* Holland, by reason of her immense national debt, the largest, comparatively, of any country, has been obliged to maintain a most rigorous and extensive system of taxation in order to raise revenue sufficient to the wants and requirements of the state. But it has been prominently brought out, in recent years, that the decadence of Holland dates almost from the hour when taxes were imposed on manufactories, commerce, fishing industry, and moneyed capital. Business went elsewhere, and with the decline of business the ability to pay taxes diminished, and the burden of taxation augmented. (See Journal des Economistes, November, 1871; also Principles of Political Economy, J. R. McCulloch, pp. 470, 471.)

and the substitution of other agencies (to be hereafter noticed) for the collection of revenue.

A fact of historical interest which ought not to be overlooked in this connection is that whenever a system of infinitesimal taxation (or a general property tax) has been projected, its authors have been led, as it were, by instinct to the conclusion that its execution, with any degree of effectiveness, must depend upon the employment of extraordinary and arbitrary measures. Thus, the old Romans, who first notably established the taxation of personal property at the period of the decadence of the empire, and who were not troubled with any restrictions of a constitutional character, or any very nice notions about personal liberty or general morality, clearly perceived this, and accordingly invested their tax officials with the power of administering torture as a means of compelling information (answering questions) and enforcing payment; and that the tax officials were not backward in using the power with which they were invested is proved by a variety of evidence.

Thus, Zosimus, who wrote in the fifth century A. D., states that the period of the tax collection upon general industry "was announced by the tears and terrors of the citizens, who were often compelled by the impending scourge" to meet their obligations; and Gibbon, in treating of this feature of Roman history, in a measure justifies the proceeding in the following language: "The secret wealth of commerce and the precarious profits of art and labor are susceptible only of a discretionary valuation; and as the person of the trader supplies the want of a visible and permanent security, the payment of the imposition, which, in the case of a land tax, may be obtained by the seizure of property, can rarely be extorted by any other means than those of corporal punishment."

And it is also especially worthy to note that in every instance in which attempts have been made of late in the United States to remedy the recognized imperfections and inequalities of existing systems of local taxation, the persons intrusted with the duty, possibly without knowing, and probably without caring, what were the experience and custom of the old Romans, have been led by their instincts and intuitions to go as far in the torture direction for the obtaining of taxes on personal property as the conditions of our modern civilization and the state of public opinion would allow.

The most curious and confirmatory evidence of this is to be found in a method of procedure adopted in the city of Boston, Massachusetts—a method which has no parallel except in the records of the middle ages and of the Inquisition, and constitutes in itself a satire upon any claim to the enjoyment of a wholly free and enlightened government. For failing to obtain satisfactory information

about the private affairs of any individual the chief assessors and their subordinates in that city, to the number of some fifty, meet in secret session in a large upper chamber set aside for the purpose, and appropriately termed the "dooming chamber," when the citizen in question, without being present either by counsel or in person, is arbitrarily doomed to the payment of any sum which a majority of those present may think proper, and from which "dooming" there can be no appeal.

The following record of the actual working of this system may be thus illustrated: During the year 1889 the whole amount of taxable personal property which the assessors of Boston were able to discover, exclusive of bank stock, was $39,000,000, of which amount $14,570,000, or thirty-seven and a half per cent, was returned as visible, and $27,650,000 as invisible. Being dissatisfied with this result, which was all that was justified by any facts which the assessors could state, they proceeded to multiply it four and a half times by a mere guess. In their "dooming" chamber they guessed that personal property, other than bank stock, ought to be valued at $186,000,000; and the citizens of Boston were compelled to pay taxes upon that amount. Could anything be more monstrous or absurd than a system of taxation which, even when administered by phenomenally honest and competent men, produces such results?

THE USE AND VALUE OF OATHS AS AN ADJUNCT OF TAXATION.—Consideration is properly asked in this connection to the use and value of oaths, an increase in the number and stringency of which is often regarded as essential to effective and equal taxation. It is the all but unanimous opinion of officials who of late have had extensive experience in the administration of both the national and State revenue laws that oaths as a matter of restraint, or as a guarantee of truth in respect to official statements, have in a great measure ceased to be effectual; or, in other words, that perjury, direct or constructive, has become so common as to almost cease to occasion notice. In fact, there has come to be a feeling in the community that an oath in respect to matters in which the Government is a party is a mere matter of form, of mechanical procedure, and that its violation, especially with a mental reservation, and when the interest of other individuals is not specifically affected, does not in itself constitute a crime. The fact that the assessors of almost every State every year make oath that they have valued all property at its actual value, when they know they have not, constitutes one proof of the truth of this assertion. The everyday entry of goods at the customhouse at undervaluation constitutes another; the enormous frauds committed in recent years under the internal revenue laws of the United States, which in the case of distilled spirits en-

tailed a loss in a single year of over $130,000,000, and in which the taking of false oaths was at every step an essential feature, constitutes a third; while of individual examples, which every assessor of experience can detail, the record would be almost interminable.

During the past few years the low tone of commercial morality in the United States has been a fact generally recognized and much commented upon; but it has not, that we are aware, been made a subject of inquiry by those to whom the guardianship of public morals is particularly intrusted. How far the existing system of laws relating to taxation—national and State—are justly chargeable with the results to which reference has been made, or how much in the division of responsibility is to be set down to the account of those who violate the law, and how much to those who, forewarned of the weakness of human nature, deliberately make laws which especially lead men into temptation, are yet unsettled questions.

A point of great interest and importance in this connection, though often overlooked, is that even if all the States of the Federal Union should entirely exempt personal property within their territory and jurisdiction from taxation, it would nevertheless, owing to the dual nature of the Government of the United States, be subject to a large measure of heavy and disproportionate taxation. Thus, the expenditure of the Federal Government, which represents taxation, was in 1896, including the cost of revenue collection, in excess of $445,000,000, not one cent of which was derived from taxes on real estate.* The aggregate of annual taxation by States, counties, cities, municipalities, and the District of Columbia for the same year is estimated by reputable authorities to have been about $400,000,000, of which at least one fifth was assessed or was collected from personal property. If real estate paid all the State taxes, personal property therefore would still be paying all the United States Government taxes, or a large excess of its equitable share of any or all national taxation. A claim that any personal property owner is justified in protecting himself against such extortion in any and every legal way has much, therefore, to be said in its favor. When such protection can not be effected legally, he has only to leave the State for others that are not extortionate oppressors of capital. But who can not perceive on reflection that personal property (capital) must be largely used by its owners and at fair rates at their residence; and that the home of such capital will show the benefit in increased local business, increased population, and increased value of real

* Real estate pays no Federal Government tax.

estate by its use? Why, then, so much overrighteous talk of personal property owners dodging taxation?

Logical and ingenious as have been the arguments in opposition to the legal exemption of personal property from taxation; the citation and consideration of the undisputed experience of all countries, people, and ages are all that is necessary to refute and disprove them. There was a time when nearly all men believed and taught that the world was flat, and when the few who lisped to the contrary exposed themselves to a charge of religious heresy and punishment. But a comparatively short navigation experience effectually put an end to all controversy on this subject; and it is doubtless only a question of time when personal property will be exempt from governmental taxation, because no system has ever been devised, or is likely to be, which will enable a state to tax it with any approach to uniformity and equity.

Origin and History of the General Property Tax.—The idea that in order to tax equitably it is necessary to assess everything capable of resulting in the obtaining of revenue is not original with the American people. Its inception dates back to the dawn of civilization, and its development may be regarded as in the nature of an economic evolution. In the incipient stages of society, as already pointed out, property consisted exclusively of things tangible and visible—lands, buildings, cattle, slaves, agricultural products, household effects, and implements—and what was exacted by rulers or chiefs of their subjects was arbitrary proportions of such kinds of property or of personal service, and was not in any proper sense taxation, but tribute. For thousands of years there were no credits or material evidences of indebtedness, as there are none at the present time among barbarians or half-civilized people; for a knowledge of letters, of the art of writing, and a somewhat durable and portable material to write upon were essential prerequisites for their existence, the earliest evidence of the recognition of anything like a mortgage being the inscriptions on certain clay tablets excavated from the ruins of the ancient cities of Babylon and Assyria, which were evidently the highest results of long and slowly developing civilization. In fact, in the early stages of society there was no important form of capital other than landed property and the instrumentalities, including slaves, for its cultivation, and so far as the system for obtaining revenue for the rulers or state merited the name of taxation, it was practically a "land" tax.

As civilization advanced, slavery gradually broke down; trade or traffic between individuals or adjacent communities extended and became commerce; free labor appeared; capital developed and multiplied the forms of visible, tangible property. Then the system

of obtaining revenue began to have the characteristics of a general property tax; and as the coincidence of great value with small bulk in some forms of tangible, visible property favored concealment, some methods of obtaining revenue from property other than mere inspection became necessary, and were obtained by the Romans in the latter days of their empire by endowing their assessors and taxgatherers (as before shown) with the power to administer torture to unwilling taxpayers, a method that was followed and perpetuated until within a very recent period by the rulers of most Asiatic countries; and in later days, when credits came into existence and extensive use, and titles to property and evidences of indebtedness were regarded as property, although intangible and invisible, a method for discovering and assessing the same, as approximate to actual torture as a higher civilization would sanction, was everywhere adopted.

And how such methods continue to exist and their practice be regarded with favor in states and communities claiming to be in the highest degree civilized and enlightened, finds proof and illustration in the following circumstance. In 1874 the Legislature of Massachusetts created a commission of three persons to inquire into the expediency of amending the laws of that State in respect to taxation, and placed at its head the chairman of the Board of Assessors of the city of Boston, a gentleman long identified with, if not the originator of, the idea of making an arbitrary, irresponsible "dooming chamber" an essential feature of tax administration. At the outset this commission was evidently impressed with the necessity of vindicating the "infinitesimal" or "general property" tax system, then and at the present time especially favored and fully exemplified in their State. And they set about it in the following manner: with the Declaration of Independence before them, maintaining it to be in the nature of a self-evident truth that "all men are endowed by their Creator with certain inalienable rights," and "that among these are life, liberty, and the pursuit of happiness," the commission gravely announced that "*the individual person*" (in Massachusetts) "*has no individual rights except that to his own righteousness*," thus laying a sure foundation in justification for a recurrence in Massachusetts to the torture tax system of the ancient Romans if its tax administrators should consider it expedient.

After the dissolution of the Roman Empire and the subsequent reconstruction, as it were, of government and society in Europe during the early feudal period, and when land was practically the only form of wealth, the payments exacted for the support of the governing powers—kings, barons, knights, etc.—were essentially and almost exclusively in the nature of land taxes; and the terms

"*danegeld*," a charge on lands at so much per hide, or an area of about one hundred acres; "*scutage*," a charge on tenants in lieu of military service; "*caracage*," a charge on "plow lands"; "*talliage*" (from the French *tailler*, to cut off), a charge on the tenants of royal manors, and the like were designations of the different forms of such assessments at different periods. As civilization advanced and was accompanied, as at a more primitive period, with an increase in the forms of personal property, a combination of taxes on land and movables, or a general property tax system, developed and was adopted by all the nations of western Europe with all the despotic adjuncts which seemed necessary to make its enforcement successful. The ultimate result of such a system was what might have been anticipated. From a very early period it occasioned great popular dissatisfaction. In Milan, Italy, as early as 1208, it was enforced with such severity "that the assessment book was known as the *libra del dolore*." In Florence it became so honeycombed with abuses and the load of taxation fell with such crushing force on the small owners of property that imminent popular revolution and disorder compelled its essential modification. As wealth increased, evasions of the tax increased in a greater proportion in every community, leaving the burden of the system, as now in the United States, on that class of the population—mainly the agricultural—that are least able to bear it. Sir Robert Cecil stated in 1592 that there were not five men in London assessed on their goods at two hundred pounds (one thousand dollars); and Sir Walter Raleigh stated in 1601 that "the poor man" (in England) "pays as much as the rich." In Florence in 1495 only fifty-two persons paid the tax on trade capital, although the amount of such capital must have been immense. Marshal Vauban, of France, who wrote on taxation about 1700, stated that the *taille personalle* was assessed only on the poorest classes. The result has been that as the difficulty of assessing visible personal property and the impossibility of reaching invisible and intangible personalty became apparent, the tax was gradually modified, and finally abolished in all European countries, except possibly Switzerland and Holland, where its nature has very little of its original and typical character. One of the first acts of the French National Assembly in 1789 was to abolish it entirely. A provision for taxing personal property under a nominal land tax continued to exist on the statute book until 1833, when, through constant exemptions and systematic evasions, the annual revenue accruing from the same had run down to the sum of eight hundred and twenty-three pounds (four thousand one hundred and fifteen dollars). It is also interesting to note that the people of Europe have been so long exempted from a general property tax that their

leading writers on economic or fiscal subjects rarely discuss it or even seem to have any knowledge of its characteristics or historical experience.*

The United States is the only civilized country that gives no heed to the world's uniform record of experience, and thinks it desirable to tax both property itself and its shadow.

PACIFIC COAST GULLS.

By HARRY L. GRAHAM.

TO my right, to my left, overhead, everywhere, gulls, gulls, gulls! Big gray fellows standing on the wharf edge; white chaps, with black heads, flapping their long, black-tipped wings and making noises that could be likened only to creaky wheelbarrows! Such was my experience one day as I walked out on the pier at San Diego, California, to take the ferryboat across the bay to the charming Coronado peninsula.

Along the wharves and on the muddy flats left bare by the receding tide, the gulls were almost as plentiful and quite as tame as the English sparrows are on the North River piers at New York city. A half dozen sat on the bowsprit of a little coaster that was loading with freight and a few passengers for Los Angeles. Out in the harbor the United States revenue cutter Monterey lay at anchor, ready for coaling up on the morrow. On her spars and flying all about her were scores of gulls, eagerly watching for some scraps of food that might be thrown from the galley.

As our boat steamed across toward the opposite shore we were accompanied by quite an escort of these interesting birds, beautiful to look at in their almost entirely white coats. Watching the flight of one bird that came close alongside the boat, I was impressed with its easy, graceful movements; every time the long, strong wings made a stroke the bird's body seemed to rise as though breasting an invisible wave, the gull all the while turning its head from side to side as if looking for something. I thought of that strange belief, prevalent in certain localities, that gulls are the disembodied spirits of those who have lost friend or relative by drowning at sea. This superstition has been versified by Mr. A. J. Burdick, and the poem is worth quoting in its entirety:

* To those desirous of a fuller record of the historical experience of the general property tax than has been here given, reference is made to an exceedingly interesting and valuable essay on the subject by Prof. E. R. A. Seligman, of Columbia University.

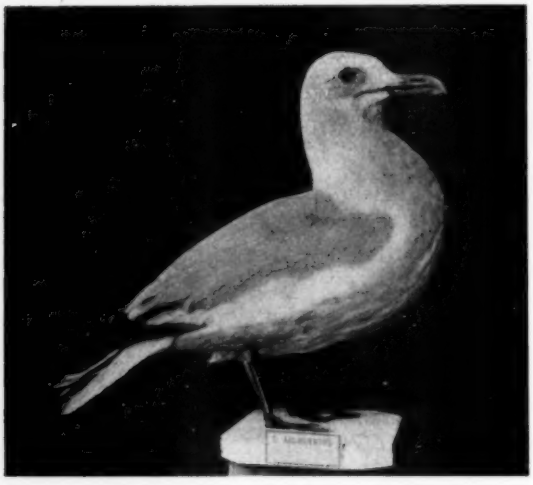
"TO A GULL.

"Soul of bereaved one, troubled and tossed,
Searching the sea for the one that was lost;
Skimming the air or riding the wave,
Seeking forever that precious one's grave;
Bird of the sea, is it true, is it true,
That the soul of some mourning one lives within you?

"Whom art thou seeking, some brother or son
Who sank to his rest ere his voyage was done?
Or was it a husband, or lover so brave
Who found an unmarked and untended grave?
Bird of the sea, is it true, is it true,
That the sea holds the one who is dearest to you?

"Bird of the sea, when the dismal winds wail,
And the breast of the ocean is swept by the gale,
When the demons of storm in their fierce anger rave,
And you sink 'neath their wrath to a watery grave,
Bird of the sea, is it true, is it true,
That the loved and the lost you find waiting for you?"

To "those who go down to the sea in ships" it is most interesting to watch the antics of the flock of gulls that follows a vessel, hour after hour, on the watch for scraps of food that may be thrown into the sea. The birds are sharp-eyed and wise, and not to be deceived by anything short of real crackers. A traveler once tried to cheat the gulls by tossing out bits of orange-peel and cardboard, but the birds paid no attention whatever until a cracker was thrown to them, when immediately a wild rush was made and the cracker seized before it touched the water.

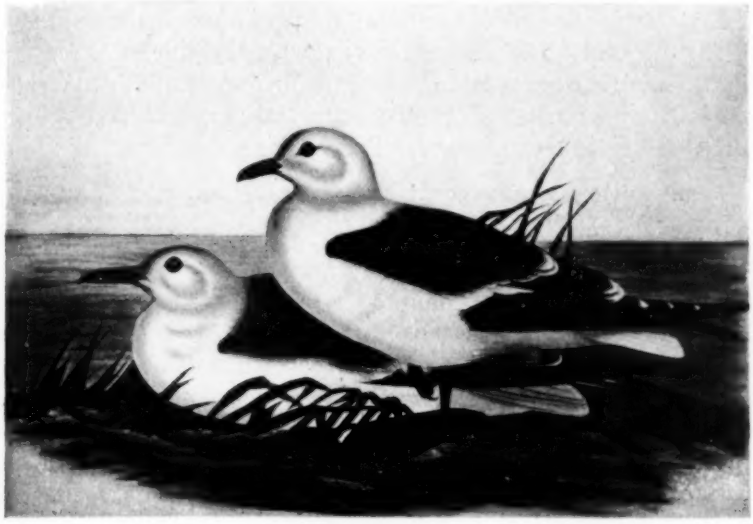


HERRING GULL (*Larus argentatus*).

It has been thought by some that the gulls which follow a ship all day return to the nearest land at night, and another flock appears the next morning. Only recently an experiment was tried that dis-

proves this theory, and I take the liberty of quoting in part from the account given in the Scientific American:

"On a late trip of one of the steamers plying between Portland and San Francisco the question came up among the passengers as to



KITTIWAKES.

whether the gulls which appeared around the ship each morning were the same birds as had been with the ship on the day previous. To test the matter, a line and fishhook were procured, and with a bait of salt pork the fishing for a sea gull was commenced.

"The first cast of the line was successful, a big gray bird swooping down on the bait. He was hauled aboard and found to be uninjured, the hook having caught in one of the glands of the beak, from which it was readily loosened. After detaching the hook a strip of red flannel was brought and carefully tied around the gull's left leg by one of the seamen of the steamer, the bird being then turned loose. Circling for a moment in the air, the gull started toward the distant blue streak which denoted the coast line, and it was generally allowed that each day brought a new contingent of gulls to follow the steamer and pick up the waste scraps from the table; but on coming on deck after breakfast the next morning there was the flannel-bedecked gull to be seen, the most clamorous of all the birds. To test the gull's reasoning power, if it had any, the same line and bait was drifted astern, the gull caught the day before being one of the first to strike for it."

During my stay at Coronado Beach I remember one delightful afternoon spent watching the birds as I lay stretched at full

length on the warm sands. Far out over the waves I saw, more than once—

> "A flock of sea birds darken into specks;
> Then whiten as they wheel with sunlit wings,
> Winking and wavering against the sky."

At the water's edge a score or more of long-billed curlews ran about, picking up crabs and shellfish cast up by the tide. A few gulls mingled with the curlews and watched for opportunities to steal the dainties they snatched from the waves. Some distance out from shore three great brown pelicans flew back and forth—

> "On solemn wings that wave but seldom while."

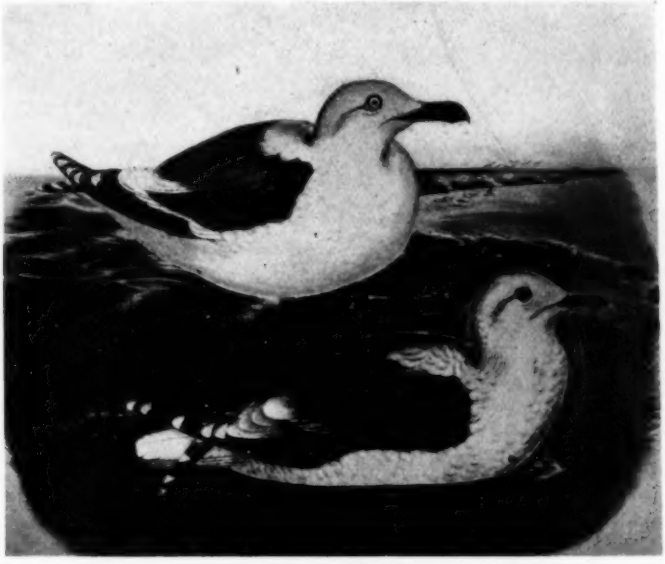
They were fishing, and at intervals one would dive with a terrific splash into the ocean after its finny prey. Through my field glass I could see the huge bird come to the surface, and with great effort mount into the air, beset on either side by those "pirates of the deep," the skua gulls, whose principal occupation is stealing from pelicans and gulls the prey they capture. Ornithologically speaking, these skuas are not true gulls, though in looks and habits there is a family resemblance. Some one has aptly called them "the hawks of the sea." They are fierce, overbearing robbers, like some of the land birds of prey.

One day on the beach, a short distance above the Coronado Hotel, I watched some Chinese fishermen casting their large net into the ocean, in the same primitive manner, doubtless, as their ancestors had done for centuries. It was not the Chinamen who particularly attracted my attention, but rather a large flock of gulls that suddenly assembled as soon as the fishermen began to haul in the net. The birds evidently knew what was coming and circled about low over our heads. I had joined the fishers and was helping to pull on the rope. At last we dragged the seine high and dry on the beach, and found a goodly number of fish in the mass of seaweed—flounders and perch, as well as a lot of "shiners" and other fish too small to be marketable. The "small fry" were tossed oceanward, but were eagerly seized upon, almost before they reached the water, by the hungry gulls. When the men had finished the work of sorting out the big fish and moved away from the seaweed pile, which still contained dozens of little fish, the twoscore impatient gulls descended with loud cries of joy, and in less time than it takes to tell it every "shiner" had disappeared.

Gulls nest in colonies, generally on the ground along sandy beaches; also on the rocky ledges by the ocean. Large numbers nest on the Santa Catalina Islands and other rocky islands off the coast of California. Their eggs are gathered and sold as food in the

markets of San Francisco. I remember how horrified I was when I first heard this. It is to be hoped that such practices may cease, for if persisted in year after year the gulls and other sea birds will soon be as scarce as are terns on the coast of New Jersey and herons and pelicans on the Florida islands.

The most numerous of the gulls along the Pacific coast was the western gull (*Larus occidentalis*), a pure white bird with a slaty mantle. The young of this species have a dusty gray plumage. I saw many Heermann's gulls (*Larus heermanni*) at San Diego—slaty, blackish birds with a pure white mantle and smaller than the western gull. The young are of a pure slate color. A number of other



WESTERN GULLS.
Larus occidentalis. *Larus californicus.*

species were seen frequently along the coast; the glaucous-wing gull (*Larus glaucus*), a large white bird with pale pearly mantle; the ring-billed gull (*L. delawarensis*), smaller, white, with pale mantle and black tips to its wings; the California gull (*L. californicus*), almost the size of the western gull, with a paler mantle.

When one thinks of a gull, it is always in connection with the seacoast, but it does not follow that you can only study the gulls beside the ocean. The American herring gull (*Larus smithsonianus*), an interesting member of the family, is frequently found hundreds of miles inland. It is a most useful bird to the farmers in Utah. I saw large flocks in the fields near Salt Lake City. They will follow the plow, just as the robins and blackbirds do in the

East, picking up great numbers of injurious insects. I am glad to say that the people of Utah appreciate the practical value of these birds, and stringent laws have been passed for their protection.

To the ordinary observer a gull would seem to be of little service to mankind, and to be looked upon only as an æsthetic addition to a marine landscape; this is not the gull's only use, as I have just proved. The gull, as well as every other bird, has a place to fill in the economy of Nature, and, as we learn more and more of the good work the birds are constantly doing for us, we will, it is to be hoped, afford them the protection they deserve.

OUR LIQUOR LAWS AS SEEN BY THE COMMITTEE OF FIFTY.

By FREDERIK A. FERNALD.

IN 1893 a group of fifteen gentlemen who had been conducting various sociological studies together formed, by adding to their number, the Committee of Fifty to investigate the liquor problem. Subcommittees on the physiological, the legislative, the economic, and the ethical aspects of the problem were appointed in the autumn of that year. The subcommittee on legislative aspects, consisting of President Charles W. Eliot, President Seth Low, and James C. Carter, Esq., engaged Dr. Frederic H. Wines, of Springfield, Ill., well known for his census reports and other investigations on the liquor question, and Mr. John Koren, of Boston, Mass., to examine the working of several typical State liquor laws. The facts obtained by Messrs. Wines and Koren constitute the first report of the subcommittee, which has been published under the authority of the whole Committee of Fifty.* Mr. Koren investigated the operation of the liquor laws of Maine, Massachusetts, Pennsylvania, and South Carolina, and Dr. Wines made like investigations in Missouri, Ohio, Iowa, and Indiana.

Much light is thrown upon the question, Does prohibition prohibit? by the conditions found to exist in Maine and Iowa. Maine has been under prohibition for nearly half a century—since 1851, with the exception of the two years from 1856 to 1858. That the famous "Maine law" has never been adequate to its purpose is shown, as the committee's agent points out, by the constant efforts

* The Liquor Problem in its Legislative Aspects. By Frederic H. Wines and John Koren. An Investigation made under the Direction of Charles W. Eliot, Seth Low, and James C. Carter, Subcommittee of the Committee of Fifty to investigate the Liquor Problem. Boston: Houghton, Mifflin & Co. Pp. 342. Price, $1.25.

to strengthen it—nearly fifty amendments having been enacted since 1858. The law provides for an agent in each city or town who shall sell liquor for medicinal and mechanical purposes, but he by no means has a monopoly of the business.

According to the committee's report, liquor may be obtained in Portland from ordinary bars under police protection, kitchen bars, pocket peddlers, hotel bars, apothecary shops, bottling establishments, express companies, clubs, and the city liquor agency. The ordinary bars have little on the outside to betray their nature, but access is easy. "In the score or so of saloons of this class visited by the writer," says Mr. Koren, "from six to twenty persons were found who were there to drink, most of them young men, some of them boys between twelve and sixteen years of age. Occasionally small girls would come in to have 'growlers' filled. Sometimes older girls appeared, to drink and to talk with the men. The customers lounged about, smoking and drinking, with an apparent sense of freedom and security."

Mr. Koren estimated the number of kitchen bars in the city at the time of his investigation at about eighty. They are found in the poorer quarters, and rely more on concealment than on protection. They do most business on Saturday evenings and Sundays, and sell little but distilled liquor. The drinking at these bars is especially productive of intoxication, both because of the quality of the liquor sold and of the opportunity of uninterrupted indulgence.

"The pocket peddlers multiply with amazing rapidity during a period of strict enforcement, and most of them disappear as suddenly in 'wet times.' At the time of the present investigation not a few were found on the wharves and along the water front after dark, especially on Sundays. They supply 'split' at the rate of thirty cents a pint for the cheapest grade. Boys of fifteen and upward were found as venders of 'split.' The pocket peddler secures many victims on incoming fishing vessels and coasting schooners, which he boards at the first opportunity." "Split," Mr. Koren explains, consists of the cheapest kind of alcohol—sometimes wood alcohol—mixed with water, with a dash of rum for flavor, and some coloring matter. It produces a violent and dangerous form of intoxication.

At least five of the principal hotels sell liquor at bars. Protection costs them in the neighborhood of one hundred dollars a month, and they are occasionally raided. Beer is sold in large quantities at certain oyster houses.

From the number of the drug stores in Portland, one to each eight hundred inhabitants, and the location of many of them, it is evident that they can not all exist for the sale of drugs. When this in-

vestigation was made all but two or three had paid the United States special tax, which is *prima facie* evidence of violation of the liquor law. Druggists can not legally sell liquor for medicinal purposes, as this is the purpose for which the city agency exists. Not less than twenty of the forty-five drug stores in Portland are merely dram-shops in disguise.

Much of the family trade is supplied by wholesale dealers and by bottlers of mineral waters, and a number of express companies are ready to place orders for their customers in Boston and other cities, while some of the local expresses fill orders for liquors from their own well-supplied storage rooms.

Of the one place in the city where liquor is legitimately sold, Mr. Koren says: "On the occasion of the writer's first visit to the Portland liquor agency he was greeted with these words by one of the attendants: 'This is nothing but a legalized rum shop—that's all.' The statistics abundantly vindicate this assertion. It was explained that certain formalities were observed. Thus the name and address of each purchaser are recorded. 'Of course,' the informant went on, 'there are some we don't sell to and won't sell to (for instance, intoxicated persons and habitual drunkards), but if a respectable person comes in we don't ask questions.'"

The inquiries of the committee's agent were not confined to cities. Farmington, the county seat of Franklin County, sixty miles back from the seacoast, was spoken of by well-informed prohibitionists as a place where the law worked under the most favorable conditions. The town contains four villages and had three thousand two hundred and seven inhabitants in 1890, of whom only one hundred and seven were of foreign birth. Yet here liquor selling is far from being unknown. "Five United States special liquor taxes were paid for by residents in 1894. At two of the hotels both malt and distilled liquors are supplied to guests in their rooms, and not infrequently to others who drop in; but there are no bars. At one of the three drug stores, at least, liquor can be bought by any trusted customer. Furthermore, it is said by old residents that illicit sales are carried on intermittently at from one to three other places, but their identity is not easily revealed. An official, whose duty it is to enforce prohibition, is quoted as saying that 'from one to six packages of liquor arrive by express every day.'"

The report contains a review of the working of prohibition throughout the State by counties. Every city in Maine, except Auburn, has its United States licenses, and in no manufacturing town with a large number of French-Canadian operatives has the prohibitory law ever been strictly enforced. The tipplers of Auburn find prohibition endurable, for a short bridge connects their city

with Lewiston, where, an official is said to have declared, "One might as well try to turn back the current of the Androscoggin River as to stop rum-selling." The existence of summer resorts in some counties prevents a rigid enforcement of the law.

Massachusetts has had since 1881 a local-option law which provides for the granting of licenses only in cities and towns voting at the annual election or town meeting to authorize their issue. Places voting "No" may grant druggists' medicinal licenses. Two communities in this State were chosen for study: Boston, the chief city and center of the liquor trade, and North Adams, in the western part of the State, one of the smaller communities under license. Various supplementary acts have been passed since 1881. License fees have been raised, so that a license to sell all kinds of liquor to be drunk on the premises now costs one thousand dollars. The number of saloons has been limited to one for each five hundred inhabitants in Boston and one for each thousand in other places.

Mr. Koren reports that "open and flagrant violations of the liquor laws by licensed dealers are no longer of frequent occurrence. This is the testimony not only of the police but of private organizations directly interested in the question. The licensees realize better than before the nature of their privileges, and know that failure to observe the conditions imposed is likely to result disastrously. Sunday sales by saloons are practically unknown. Innholders may be found, however, who resort to peculiar methods of registering guests in order to sell liquor after hours under a guise of legality. Those who are bolder are pretty sure of punishment when found out. Few liquor shops would now dare to sell to minors where their minority is obvious. Sales to intoxicated persons occur commonly, as a matter of course; and any one can obtain, without the slightest difficulty, enough drink to produce intoxication. On the other hand, numerous dealers persistently refuse persons visibly under the influence of liquor." Illicit selling is confined within steadily narrowing limits. There are still some kitchen bars in the poorer sections of the city, whose best customers are the persons who come in from the surrounding no-license towns on Saturday evenings and Sundays for the avowed purpose of obtaining drink.

The population of North Adams contains a large element of factory hands, nearly all of whom are of foreign birth or extraction. The saloons are confined within a small section where they are under close supervision. "The general provisions of the law," Mr. Koren reports, "such as those against maintaining screens and selling after hours, are well observed. Sunday sales by licensed dealers even in hotels are practically unknown. The revocation of licenses for this cause has had a wholesome effect. A system of posting intem-

perate persons in saloons is in vogue, and admirable results are claimed for it."

As to the rest of the State, Mr. Koren says: "That the sale of liquor is as well regulated in all the other large cities and towns of Massachusetts as in Boston and North Adams is much to be doubted. In most of the license cities the bane of the influence of the liquor element in local politics is strongly felt; as a result, enforcement is lax and defiance of express provisions of the law common." We are not told whether or not liquor is sold in places where no licenses are granted, but Massachusetts probably does not differ much from Maine in that respect. The largest cities and towns that usually vote no license year after year are circled around Boston, "where a no-license vote removes the drinker a short and not seriously inconvenient distance from the base of supplies."

Pennsylvania has its "Brooks law," which went into effect in 1888. It is a high-license measure and embodies various restrictions. Much improvement in the character of the liquor trade has been secured under it in Philadelphia, chiefly through the efforts of the Law and Order Society of that city. Licenses are granted by the Court of Quarter Sessions in each county. The work of the license court in Philadelphia is highly praised. Owing to the connection which the liquor interest maintains with politics the full intent of the Brooks law is not carried out. Every application for a license has to be indorsed by twelve reputable electors of the ward, borough, or township in which the saloon is to be opened. In Philadelphia, school directors, members of city councils, police magistrates, clerks of the Courts of Quarter Sessions, State senators and representatives, officials of Protestant churches, and members of Congress frequently sign from one to thirty applications. It has been said by one well acquainted with existing conditions that "few men, least of all those connected with politics, dare refuse requests to aid applicants for licenses." There is an average of one saloon to each five hundred and sixty-two of the population. Liquor dealers are largely restrained from illegal practices by the fear of losing their licenses. "The improved character of the saloon," says the committee's agent, "is remarked upon by all observant citizens. Sunday selling has ceased, and minors are usually kept out of the saloons. The wholesale dealers have stopped selling liquor to be consumed on their premises. In many places great care is taken not to sell to persons already visibly under the influence of liquor."

The agent reports a large number of "speak-easies" or "kitchen bars" in Philadelphia which political entanglements or bribery prevents the police from suppressing. Liquor-selling goes on also in a multitude of clubs, so called, some of which are recognized political

factors. Pittsburg, with its large element of mill workers in its population, and most of its more intelligent citizens absorbed in money-getting, has only a lax enforcement of the liquor law, while in the large towns of the mining districts conditions are still worse. In Berks County, an agricultural region, are many inhabitants of German descent who insist on having plenty of hotels where they can get their beer.

Prohibition has been thoroughly tried in the West, in the State of Iowa. When the Clark act, which materially strengthened the prohibitory law already existing, was passed in 1886, it closed saloons by wholesale. At the same time it greatly stimulated the trade of drug stores in alcoholic liquors, and led to many sham drug dispensaries being opened.

"But the drug store was by no means the only source of supply," says Dr. Wines, who reports on this State. "Secret and illicit sales were common. The amount of supervision and espionage necessary to prevent them was beyond the reach of municipalities, even where there was a disposition to suppress illicit traffic. The schemes adopted in order to avoid detection were varied and ingenious. The man who went around with a concealed bottle upon his person, and dispensed drinks of the vilest composition in back alleys, was known as a 'boot-legger.' Few dealers sold openly. They had a store of liquor in one place, from which hidden pipes conveyed it to another, where it was dispensed; the faucets through which it was drawn were cunningly placed, out of sight, in the most extraordinary places. Or the liquor was in a cellar or subcellar beneath a secret trapdoor, and was sent up, on receipt of the price, by means of a concealed hoist or dumb waiter; or a step in a stairway was so constructed as to lift up, on hinges, and reveal a well-filled glass; or the glass was sent in through a partition wall by means of a revolving closet. There was no end to these devices, in most of which the customer did not see the man who supplied the liquor, nor the dealer the man who drank it." In rural and temperate communities these evils did not exist. On the other hand, there were counties in which the law was evaded with the collusion of officials, or was openly defied.

Prohibition had been inaugurated as a political move, and for some years served its purpose well. But the party that had taken it up found it growing unpopular, and in 1894 an end was made of prohibition in Iowa by the passage of a mulct law.

The idea of the mulct law was borrowed from Ohio. By the Dow law of that State the traffic is neither prohibited nor licensed; it is simply taxed, and many of the usual restrictions are thrown around it. The tax is two hundred and fifty dollars a year, and is

a first lien on the premises occupied. The dealer is civilly liable for loss and damage resulting from the intoxication of any person to whom he may have sold or given any intoxicating liquor, and this liability extends to the owner of the premises. The guardian or any near relative may enjoin the sale of liquor to any individual. The law provides also for local option as to prohibition.

Statistics indicate some decrease of drunkenness in public since the law has been in effect. The law has not taken the saloon out of municipal politics, although there has been in ten years only one election of State officers in which the liquor question is thought to have affected the result. The dealers are impatient of any restrictions, and are constantly working against a strict enforcement of them. That against selling on Sunday is especially irksome to them. In Cincinnati the police declare it to be impossible to close the saloons on that day. The dealers are arrested, but juries can not be got to render verdicts of guilty. Public opinion is not behind the Sunday-closing law.

No recent attempt of any State to solve the liquor problem has attracted so much attention from the rest of the country as the dispensary system of South Carolina. It has become conspicuous from the vigor with which it has been enforced by Governor Tillman, who suggested it, and the resistance that has been offered to this enforcement rather than from novelty in the plan itself, for its chief feature is simply the town and city liquor agency of Maine adopted from Athens, Ga., where it had been tried with success. The dispensary law provides for one dispenser at the county seat of each county, and permits county boards of control to establish dispensaries in other towns. There is a State commissioner who buys the liquors, and is required to give a preference to distillers and brewers in the State. Every package of liquor must be sealed and bear a certificate that it was bought by the commissioner; a package shall not contain less than a half pint nor more than five gallons. The local dispenser shall not break the seal of any package; he must sell by the package only, and the purchaser shall not open a package on the premises.

The law effected a general closing of saloons throughout the State, but many unlicensed dramshops, called "blind tigers," took their place. At the time of the committee's investigation there were eighty-one dispensaries in operation. Buying the dispensary liquors from South Carolina distillers has led to the purchase of much liquor that was not sufficiently aged, and hence highly intoxicating. Many ardent prohibitionists denounce the participation of the State in the "unholy traffic." Well-digested statistics show an unmistakable decrease of drunkenness and disorder in the cities,

but in some country districts an increase is reported. In the opinion of Mr. Koren, "so far as the cities and towns are concerned, the dispensary system has already reached the limits of its usefulness as a temperance agent. Any further addition to the State liquor shops in the cities where they already exist would be a direct invitation to drink. With the law so generally and rigidly enforced as at present, any multiplication of dispensaries in semi-rural districts can have no other purpose than to raise revenue and put more wheels into the political machine."

From the reports prepared by its agents the subcommittee draws the following conclusions: Prohibition has abolished or prevented the manufacture on a large scale of alcoholic liquors within the areas covered by it. Its success in suppressing the retail traffic depends upon the state of public sentiment in each locality. The efforts to enforce it have led to hypocrisy and unfaithfulness in public officials, to bribery and corruption, and to disrespect for law. Its general effect with regard to diminishing drunkenness remains a matter of opinion, no demonstration being yet attainable after more than forty years of experience. The prohibition over small areas that is secured through local-option laws has the advantage of always having public sentiment behind it. One of the chief objections to the license system is that it compels the liquor traffic to be in politics for self-protection. The enforcement of common restrictions on the sale of intoxicants is also dependent on public opinion. The removal of private profit from the liquor traffic is a desirable end for which no American legislation has yet proved effective. It can not be positively affirmed that any one kind of liquor legislation has been more successful than another in promoting real temperance. The influences of race or nationality are apparently more important than legislation. It is often said that restrictions on drinking at public bars tend to increase drinking in private, and there is probably truth in this allegation. All things considered, however, the wise course for a community is to strive after all external, visible improvements, even if it be impossible to prove that internal, fundamental improvement accompanies them.

BIRDS have curious ways in the selection of materials for their nests. An oriole's nest found by M. Marcel Plaideau near Lille, Belgium, was composed of white wool and Morse telegraph paper, which the bird had to go three kilometres to the nearest telegraph office to get. It might be suggested that the bird knew in some way how warm a covering paper makes; but then we hear of nests near Besançon, France, made of watch-spring steel; and a bird is told of that robbed a St. Bernard dog of his hairs to construct a nest.

AN EARLY AMERICAN EVOLUTIONIST.

By CHARLES MINOR BLACKFORD, Jr., M. D.,
PROFESSOR OF PATHOLOGY, UNIVERSITY OF GEORGIA.

AS a general rule, the influence of the theory of evolution as a potent factor in the biological sciences is considered to date from the publication of the Origin of Species in November, 1859. It is true that the theory did not originate with Mr. Darwin. It may be traced in more or less definite shape through the whole history of philosophy, and in our own century Lamarck * formulated a doctrine of development as fully as could be done with the data at hand in his day. The Origin of Species was fortunate in finding an expositor so simple and clear in style, so accurate and full in scientific knowledge as Mr. Huxley. Equally at home before the British Association for the Advancement of Science or a Workingmen's Lyceum, he brought to his subject the same conviction of right, the same strong, vigorous English, and the same rigorous logic that had enabled him at the age of thirty-five to face the Bishop of Oxford, and Owen, the foremost anatomist of his time, and vanquish each in turn before the greatest assembly of scientific students that gathers in Great Britain. With such a disciple and apostle it is not wonderful that the name and fame of Darwin should have been indissolubly connected with evolution, although his chief work in relation to it was an effort to determine the precise means by which variation was perpetuated and increased.

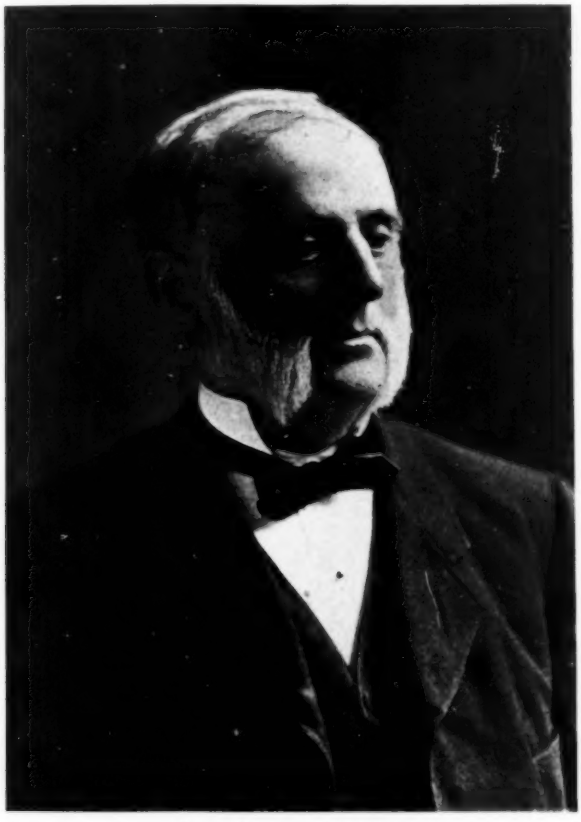
How the religious world rose in arms at the suggestion of such a hypothesis is well known. From the College of the Propaganda to the most extreme of the dissenting churches, all shades of religious opinion united to denounce the theory and those who upheld it, and the echoes of the conflict have not died away even now. Under these circumstances it is with a curious interest that we examine a work that was issued a few months before the Origin of Species saw the light, and, after seeing how fully it foreshadowed the later work, compare the approbation with which religious leaders hailed it with the denunciation heaped on the other by the same writers.

The title-page reads: The Testimony of Modern Science to the Unity of Mankind, being a Summary of the Conclusions announced by the Highest Authorities in the Several Departments of Physiology, Zoölogy, and Comparative Philology in Favor of the Specific Unity and Common Origin of all the Varieties of Man. By J. L. Cabell, M. D., Professor of Comparative Anatomy and Physiology in the University of Virginia. With an Introductory Notice

* Philosophie Zoologique. Par J. Lamarck. Paris, 1809.

by James W. Alexander, D. D. New York: Robert Carter & Brothers, No. 530 Broadway, 1859.

Such is the wording of this title that it received the indorsement of no less an authority than Dr. Alexander, and the "introductory notice" is full of the highest praise of the work and of its leading idea.



JAMES LAWRENCE CABELL.

Americans may well be proud of this book, as it states many of the biological laws now recognized, and, strange to say, cites many of the very instances used later by Huxley and Darwin to support them. Among these we find, on page 22, that by changing food and environment, "we may modify to an extent sometimes quite considerable the outward structural character of many plants and low animal organisms; and these newly acquired characters may then be perpetuated by hereditary transmission, under the influence of the law of assimilation between parent and offspring, even though the causes which originally determined the variation from the primi-

tive type have ceased to operate. A similar effect is produced in those cases in which a given variation appears accidentally in a single individual and is then transmitted to his offspring. . . . In other words, a permanent variety is likely to arise." In the Origin of species, Chapter I, in speaking of variations, Darwin says: "We are driven to conclude that this great variability is due to our domestic productions having been raised under conditions of life not so uniform as, and somewhat different from, those to which the parent species had been exposed under Nature." The same idea is here expressed in somewhat different words, and Darwin's notion as to the transmission of such peculiarities by heredity is too familiar to be repeated.

As an illustration of the law thus laid down, Cabell cites the well-known story of the origin of the Ancon or Otter sheep from a spontaneous variation occurring in the flock of Seth Wright in Massachusetts; and it may be remembered that Huxley uses the same incident in the same relation, but without reference to its previous use by Prichard and Cabell. As further evidence, he brings forward the changes arising in the horses and cattle that were brought to this continent as domesticated animals, but escaped into the forests and plains, and shows that without admixture—for these animals are not indigenous—varieties arose differing from the parent stock so markedly as to constitute new species. On the other hand, he shows that the hog, an exotic animal brought here under domestication, reverted to the primitive stock. So striking is this that it will repay copying in full (page 31):

"The hog is known not to be indigenous to this country, but was introduced into St. Domingo at the first discovery of that island in 1493, and successively to all the places where the Spaniards formed settlements. These animals multiplied with great rapidity and soon invested the forests in large herds. At length, under the influence of their wild state, they have resumed the characters of the original stock—that is, their appearance very closely resembles that of the European wild boar, from which the domesticated breeds have sprung. Their ears have become erect, their heads are larger, and their foreheads vaulted at the upper part; their color has lost the variety found in the domestic breeds, the wild hogs of the American forests being uniformly black. The hog which inhabits the high mountains of Paramos bears a striking resemblance to the wild boar of France. His skin is covered with thick fur, often somewhat crisp, beneath which is found in some individuals a species of wool. Thus the restoration of the original characters of the wild boar, in a race known to have sprung from domesticated swine brought over to America by the Spaniards, removes all reason for

doubt, if any had existed, as to the identity of the wild and domesticated stocks in Europe, and we may safely proceed to compare the physical characters of these races as varieties which have arisen in one species." (Unity, etc., pages 32, 33.)

As will be remembered, the leading instance of reversion cited in the Origin of Species is the tendency of fancy breeds of pigeons to return to the "blue rock," from which fact Mr. Darwin concludes that to be the original stock. As the hog is a more highly organized animal than the pigeon, this flexibility of species in it is more striking than in the oviparous pigeon.

As suggested above, it is probable that much of the interest excited by the Origin of Species was due to the brilliant exposition of Mr. Huxley; but, aside from that, unquestionably the chief reason that so many without the ranks of professional biologists discussed its reasoning so eagerly and earnestly was the bearing it had on the genesis of man. Mr. Huxley's lectures touched almost every branch of modern science—zoölogy, bacteriology, geology, sociology—all were equally familiar to this, perhaps the greatest public lecturer of our race, but to none of them did the laity give the rapt attention that was and still is given to evolution. The bearing of spontaneous variation among the lower orders of living organisms on the human race was clearly seen by Dr. Cabell, and the object of his work was to offset the arguments of those who claimed a plurality of genera among men by showing that lower organisms develop varieties without the intervention of any supernatural creative power. As a necessary inference from this, and, indeed, that it should have any bearing at all on the problem of humanity, he must have held that there was no radical difference between man and other animals.

The similarity between the arguments used by Cabell and those to be used a few months later by Darwin is striking, and equally remarkable is it that both should have foreseen objections to the theory, and that these objections are essentially identical. The difficulty of defining species as distinct from variety impressed them both; the alleged sterility of hybrids, an objection answered by both by showing it not to be invariable; the lack of intermediate forms, attributed by Darwin to the imperfection of the geological record and by Cabell to imperfect geographical knowledge, and several similar instances, can not fail to impress an attentive reader.

This neglected volume is a wonderful monument of painstaking labor and erudition, and although overshadowed by the more extensive works that appeared a few months later from the great English writers, it is one in which American biologists may take pride. Most remarkable, however, is the fact that it was greeted with de-

light and exultation by the leaders of religious thought, whereas the work of Mr. Darwin, hardly more than an expansion of Cabell's Unity, in which the same arguments and many of the same instances appeared, was denounced with all the vigor of ecclesiastical vituperation. The reason for this difference in reception is not easily seen.

EXCURSIONS OF THE RECENT INTERNATIONAL GEOLOGICAL CONGRESS.

By Prof. DANIEL S. MARTIN.

THE recent meeting of the International Congress of Geologists at St. Petersburg has led incidentally to an important series of publications regarding the geological features of a large portion of European Russia, the Urals, and the Caucasus. Everything connected with the meeting was arranged upon a most extensive and liberal scale, and especially the great series of excursions before and after the congress. For these there was prepared a set of handbooks, describing the leading points of geological structure and economic importance, and bringing together a great body of results of recent study, either unpublished before or scattered through various Russian and German periodicals and transactions, and practically inaccessible to the ordinary student. These handbooks or "guides" were prepared with great care by a number of prominent Russian geologists, who divided the routes of the excursions into sections, and went over them in detail during the previous year. When completed the reports were translated into French (a few into German) and beautifully printed as octavo pamphlets. These, to the number of thirty-four, were bound together in a volume of six hundred and forty-eight pages, with a spring cover, such that each paper could be taken out and used separately during that part of the journey which it described.*

The general editor, Prof. Th. Tschernytschew, observes, in his very modest introduction, that this is the first publication of the kind that has been issued in Russia; and while it can not be placed in comparison with such great general works as have appeared in other lands, like Oldham's Geology of India, Woodward's Geology of England and Wales, or Lepsius's Geologie von Deutschland, he hopes that it may yet present to students a more complete and "up-

* Guide des Excursions du VII. Congrès Géologique International; avec 39 planches, nombreuses figures, cartes locales et une carte géologique de la Russie d'Europe à l'échelle de $\frac{1}{6\,300\,000}$. St. Pétersbourg: Imprimerie de M. Stassuléwitsch, Wassili Ostrov, 5 ligne, 28, 1897.

to-date" outline of the geological features of Russia than has before been attainable.

The volume was prepared for members attending the congress and presented to them. The very few copies that have reached this country have been brought by American delegates who have lately returned. Whether, or how far, the work will be procurable hereafter through any ordinary channels does not yet appear. It is to be hoped, however, that at least our scientific institutions and libraries may be able to secure copies of so valuable a treatise.

The general outline of the excursions was as follows: During the month prior to the meeting, a journey to the celebrated mining and mineral regions of the eastern Urals, the route being from Moscow by rail south and east, by Penza to Oufa, passing through the Urals to Zlatoust; then by the Ural Railway, which runs parallel to the mountains on the Asiatic side, north to Ekaterinbourg and the mining district of Tagilsk; thence recrossing the Urals to Perm, and from there by steamer down the Kama and up the Volga to Nijni Novgorod and back to Moscow by rail.

After the congress another great trip was arranged for—to southern Russia, the Caspian, the Caucasus, and the Crimea; this comprised several selections or "variants." The main route was from Moscow to Vladikavkaz in the Caucasus, one section going by rail through the valley of the Don; another proceeding by Kiev and taking the Dnieper valley; and a third going to Nijni Novgorod, and by steamer down the Volga to Astrakhan and on the Caspian Sea to Petrovsk; and all meeting at Vladikavkaz. From this point the route led by the great military road of Georgia, south to Tiflis, and thence to visit the oil deposits at Baku on the Caspian, returning by Tiflis to Batoum on the Black Sea, and by steamer to the Crimea, the excursion breaking up at Sebastopol.

A number of side trips to points of special interest were further associated with these excursions, and there were also two shorter excursions—one to Esthonia and one to Finland—for the study of early Palæozoic and Archæan rocks and glacial deposits.

These outlines are necessary in order to give an idea of the extent of country covered by the series of guidebooks that compose this notable volume. The first monograph is a description of the geology of Moscow and its environs, by Professor Nikitin; the last, by Prof. F. Schmidt, deals similarly with the vicinity of St. Petersburg. The remaining thirty-two take up *seriatim* the districts traversed by the several excursions and "variants." Nearly all of them are freely illustrated with sections, maps, diagrams, etc.; some have interesting views and photographs, and the more important have

complete references or bibliographies of the previous work done in the regions described.

All that can be attempted in a brief outline like the present is to indicate the general scope of the principal papers, and to refer to certain points presenting special interest.

Following the general course of the first excursion, which is all that can be done in the present article, we have three papers on the geology of the route through central and eastern Russia to the Ural Mountains. Much of this great region has been little studied since the classic researches of Murchison, save that in recent years several Russian geologists have been engaged upon it at various points; but their work is largely inaccessible, and much of it is not yet published. Article No. 1, on the environs of Moscow, and No. 2, from Moscow to the city of Oufa, are by Prof. S. Nikitin; No. 3, by Professor Tschernitschew, covers the route from Oufa to the eastern slope of the Urals.

In the whole vicinity of Moscow the general section gives, beneath the modern surface deposits, two well-marked Quaternary divisions, resting upon Cretaceous beds (Neocomian and Aptian), and these upon an important body of what Nikitin has termed Volgian deposits, upper and lower. Beneath these are Jurassic beds (Kimmeridgian to Callovian inclusive), underlaid by Carboniferous strata of the stage called here Moscovian. The Quaternary deposits consist of a widespread morainic bowlder clay, unstratified, and filled with transported stones from Finland and northern Russia; westward this passes directly into the lower "Geschiebelehm," or Saxonian bowlder clay, of the Germans, and is the product of the great Russo-Scandinavian ice sheet. Above this is an unstratified bowlder sand, and below it lies a stratified bowlder sand, the latter containing a larger proportion of material from the rocks of the vicinity. Professor Nikitin holds strongly that here, and through the whole of central Russia, there was but one period of ice-covering and moraine deposit, with no indications of repeated advances or of interglacial beds. The upper bowlder sands he refers to the period of retreat of the great Russo-Scandinavian glacier, and attributes them to the action of streams and melting ice.

The chief point of novelty and interest, however, in this Moscow section is the relation of the upper and lower Volgian beds, which are important formations over a very large area. They have been variously considered by different explorers of late, some regarding them as lower Cretaceous, and others as upper Jurassic. Their stratigraphic position is clear; their fauna shows marked Jurassic relations at the base and Neocomian relations in the upper portions. Professor Nikitin regards them as a distinct series, lying between the

upper Jurassic and the Cretaceous and connecting the two; so that there is not in Russia any such gap between these systems, in his view, as is recognized in western Europe. The fauna, however, requires more detailed study before positive results can be assured. He gives much space to this discussion, in which we can not follow him here.

The Jurassic beds below present a close correspondence throughout the whole of central Russia to those of the north and west of France, and no marked differences can be observed.

The Trias and the Permian are here wanting, and the Mesozoic rocks lie directly on the limestones of the "Etage Moscovien" of the middle Carboniferous. Both are fairly rich in fossils, and at the base of the Callovian is a conglomerate in which characteristic Callovian fossils are intermingled with rolled fossils of the underlying Muscovian.

In the journey southward and eastward, from Moscow to Riazan, Penza, Samara, and Oufa, these same rocks occupy the greater part of the way, with much of interesting discussion, until some other features begin to appear as the route approaches the Volga, which it follows from Syzran to Samara. The lower Quaternary bowlder clay begins to disappear and gives place gradually to an upper series of deposits of mingled fluvial and æolian character, the most marked of which are the "loess" and a heavy "terrace clay" of the valleys, with a variety of intermediate types.

At Syzran the general uniformity of the structure is broken by an anticlinal elevation, in a north-to-south course, crossed by an important line of fault, west-northwest and east-southeast. These movements have produced a line of hills, which have deflected the course of the Volga, and are the only examples of the kind in this extensive region. Professor Nikitin places the period of their elevation in the early Tertiary.

At this point a very interesting feature first appears—the occurrence of deposits laid down by the former extension of the Caspian Sea. They are first seen near Syzran, in a baylike portion of the valley of the Syzran River, and thence become more marked in traveling eastward. They are chiefly clayey sands and conglomerates, with rolled pebbles of the underlying Cretaceous rocks. They appear on the divides and higher portions of the banks of the Volga and its affluents, and are evidently older than the "terrace clays" of the upper Quaternary. At many points they contain brackish water shells of late Caspian type. We have here the evidence of the Pleistocene extension of the Caspian waters over the great valley of the Volga as far north as latitude 53°, and even farther.

Crossing the Volga near Samara, the route enters upon a wide

valley which passes gradually into the great trans-Volgian steppes. Much interesting discussion as to the peculiar soils of the steppes and their relations to geology and to tree-growth can only be alluded to. In proceeding eastward the great Permian formation, so named by Murchison, begins to appear, forming a broad band or zone stretching along the western base of the Urals. The "tchernozem" or surface soil of the steppes rests upon successively older rocks as the route passes northeastward from the Volga toward the mountains. Beneath it appear more or less of the Caspian deposits, partly overlaid and partly connected with the "terrace clay" of the Quaternary. The underlying rocks are in succession Cretaceous, Volgian, Jurassic, and Permian, as this wide area is traversed. Permo-carboniferous and Carboniferous rocks are met on entering the Urals, the lower members of each appearing successively, and, when the folds of the mountains are fully reached, a great body of Devonian.

Between Samara and Oufa, as the steppes rise, the country presents an aspect which Professor Nikitin observes as strikingly like the eroded plateau regions of the western United States. This is particularly well marked in the valley of the Dioma River, where high level regions of nearly horizontal stratified sediments have been worn down along all the drainage lines into scarped and picturesque heights, with broad, flat areas of intervening watershed—as we should call it, a country of cañons, mesas, and "mauvaises terres."

The rocks of this region are principally Permian, but the Russian geologists are not fully agreed as to the details. A great body of limestones, marls, and sandstones, definitely of upper Permian age ("Zechstein"), lies between two distinct series of "*marnes irisées*" —red and variegated marls. The lower of these is undisputed (the "Rothliegender"), but the upper is regarded by some as also true Permian, and by others as transitional to the Triassic. For this upper series the name "Etage Tartarien" is employed.

It is interesting to note how much more continuous the geological succession appears to be here than in the west of Europe. The recognition of the Permian itself, as a whole, was an immense advance in this direction; and now we can almost trace it downward through the Permo-carboniferous and upward through the Tartarian, connecting the Palæozoic and the Mesozoic continuously. In the same way, and in almost the same region, the Volgian series appears to unite the Jurassic with the Cretaceous.

From Oufa to and through the southern Urals the description is taken up by Professor Tschernitschew. The structure of the Urals bears some marked resemblances to that of our Appalachians; the general course is much the same, north-northeast to south-south-

west, and the principal character is that of a series of parallel folds, with the anticlinal crests eroded into longitudinal valleys, so that each axis of elevation produces two parallel lines of heights. Similarly, too, the disturbance increases from the west eastward, and metamorphic and intrusive rocks appear and attain a great development toward the Asiatic side. Beyond, moreover, forming a separated though intimately connected portion of the system, are the Ilmen Mountains and others that align with them, highly metamorphic, much intruded, and exceedingly rich in mineral treasures. These recall our Blue Ridge range in its geographical relation to the Alleghanies, though their connection with the Urals is much closer geologically. Finally, the Ural range, like our true Appalachians, is monogenetic—i. e., the product of a single period of elevation.

The body of the southern Urals consists of Devonian and Carboniferous beds, much inclined. The latter are principally limestones, while the former, largely also calcareous above, become more fragmental lower down. The succession of stages is very regular in each, and is discussed at length. In the lower Devonian (Hercynian) occurs a hard and heavy sandstone, which by its resistance to erosion forms generally the crests of the parallel ridges. This sandstone not only passes into quartzite, but becomes at times micaceous and takes on a distinctly metamorphic habit. Professor Tschernitschew gives a clear and detailed account of the gradual passage of this sandstone into various kinds of micaceous, talcose, and chloritic schists. In the eastern Urals intrusive rocks appear more and more, mainly granites and diabases. Of these there are again many particulars given, and especially interesting accounts of the contact phenomena, where these dikes and veins have traversed the sedimentary rocks and produced local alteration.

In regard to Quaternary deposits the remarkable fact is brought out that there are no definite traces of glaciation in the Ural Mountains south of latitude 61°. All the surface deposits are local, either the work of streams or from the decomposition of rocks in place, after the manner of our "southern drift." For this latter process and its results the words "éluvion" and "dépôts éluviales" are used in these treatises in distinction from material removed and redistributed by flowing water—a convenient and desirable term. Most of the gold placers of the Urals are of these kinds—alluvial in some places and eluvial in others, but not glacial. In some cases the auriferous gravel and sand can be traced downward almost directly into the disintegrating quartz of an outcropping vein.

The main Urals are rich in iron ores, chiefly hematite and spathic iron; in the Ilmen range the ore is magnetite and occurs in a differ-

ent geological relation. The oxide and carbonate are associated with dolomitic limestones of the lower Devonian, and may be traced into them by a gradual transition, as at the mines of Bakal, where the ore is hematite for some distance below the surface, then passes to spathic iron, and this into dolomitic limestone at a considerable depth.

After traversing the Urals to Zlatoust, where are the great iron and steel works that produce some of the finest weapons used in the Russian army, and that sent an elegant exhibit to the Chicago World's Fair, the excursion traversed the famous mining and mineral region of the Ilmen Mountains northward to Tagilsk and Ekaterinbourg. This portion of the route is treated of in several papers as follows: The Eastern Slope of the Urals (No. 5), by Prof. A. Karpinsky; The Minerals of Kussa and Miass (No. 4), by A. Arzruni; The Gold Deposits of the Southern Urals (No. 6), by N. Wyssotsky; The City of Ekaterinbourg and its Environs, especially in Reference to Prehistoric Archæology (No. 7), by Dr. O. Clerc; The Mining Districts of Tagil and Gora-Blagodat (No. 9), by Professor Tschernitschew; and one or two minor articles.

Professor Karpinsky gives an admirable account of the region of the eastern Urals and beyond, emphasizing the contrast between the two sides of the system. While the western slope passes by gradual and gentle undulations into the plains and steppes of European Russia, the Asiatic side has been enormously eroded away. A wide belt of country along the eastern base of the Urals, consisting of upturned and folded rocks identical with those of the mountains, has been leveled down to an absolute plain. Over this are spread the deposits of the Tertiary sea that reached in Pliocene time nearly to the central ranges of the Urals, and that has largely obliterated their eastern portion. These deposits stretch far away into the great Siberian plain. Along their western edge, and for some distance eastward, they are strewn with lakes—some fresh and some salt; some deep and narrow among the folds of the edge of the mountain region; others broad, shallow, and with flats and benches of gradual contraction in the level country to the east. Two striking views of this lake-bestrewn plain from the top of some of the Ilmen peaks are given in the monograph.

The gold of the Urals, of course, receives much attention in these papers; the placers are carefully described, and the quartz mining also, which in some districts is overtaking and surpassing the placers in output. Closely connected with these are the platinum workings, thus far wholly surface deposits. But it is of great scientific interest to note the definite tracing of this metal to its original rock source, associated with chromic iron in serpentines, which

themselves are altered peridotites. These facts are not actually new, but they are recent and little known.

Especial interest gathers around two great mineral and mining centers—Miask, at the southern base of the Ilmen Mountains, and Tagilsk, toward the northern part of the route, near Ekaterinbourg. The rocks of all this region are metamorphic and intrusive, of great variety, and are described in some detail. At times the limestones are not so changed but that they retain determinable fossils (Devonian). The Miask region is remarkable for the varied and in some cases peculiar character of its rocks and the great number of minerals contained in them; the locality is celebrated in this respect, but can not be dwelt upon here. The Tagilsk region is notable for its great iron and copper mines; the former are magnetite masses so intimately associated with porphyry that Professor Karpinsky can only regard them as of similar and contemporaneous origin. There are several great mines in and around the rather isolated porphyry hill, Mount Wyssokaia; of these the oldest is that of Nijni Tagilsk. Adjacent to it, below the hill, is the copper mine of Mednoroudiansk, which has furnished all the beautiful Siberian malachite so familiar in collections and in Russian works of art. Unfortunately, the name of the iron mine, Nijni Tagilsk, has so long been connected with the malachite that the error can scarcely now be corrected. This name, however, is that of the district as well, and so may be used for the copper locality in a general sense.

The copper ores are a later deposit, amid tufas connected with the porphyry of the hill.

From these points the railroad turns westward, crosses the main Urals, here not very elevated, and gradually descends to the city of Perm. The route traverses much the same succession of rocks, in reverse order, as was described in approaching the mountains from the east. This portion is treated of by Professor Krasnopolsky, and the steamer route on the Kama and Volga to Nijni Novgorod by MM. Stuckenberg, Nikitin, and Amalitzky. All these contain much of geological and geographical interest, but there is not space to go into further particulars.

From Nijni Novgorod, the city of the great annual fair, where fine sections of the several horizons of the Permian are directly covered by Quaternary loess-like clays, the party returned to Moscow. Here we must close this very hasty sketch, which can only give the faintest idea of the extent and interest of the tour through regions so little known and so little accessible to the majority of geological students.

THE FEAR OF DEATH.

By M. GUGLIELMO FERRERO.

MAN occupies in view of death a situation that is peculiar, for he is probably the only being that knows he has to die. The battle against death spurs an immense number of men to study and work; and all the great intellectual and moral creations in art, religion, and science have been produced under the influence of the feelings excited by the certainty of that event. Yet the psychology of the ideas and emotions relative to death is still to be constructed.

Man is not normally preoccupied with the thought of death. While he is in full vigor of health and strength he is not afraid of it and takes little heed of it. The idea that he will have to die some day rarely enters his mind, and when it does present itself it is so vague and relates to an event so uncertain as to the time when it will occur that no distress is produced by it. This inertia of the thought of death in the strong man follows from the important agency exercised by organic sensations in determining the psychical condition. We know that not only exterior phenomena acting on the sensorial organs that are directed to the outer world produce sensations in us, but changes of condition originating in the organism itself are also accompanied by sensations. The parts of the body that are by their situation withdrawn from the direct influence of external agents possess a special sensitiveness through which we perceive their changes of condition. One of these sensations, for example, is the feeling of fullness after dinner, the sign of an abundance of food in the stomach. The same stomach, empty, gives the painful feeling of hunger. In the field of organic sensibility sharply defined sensations are given only under abnormal conditions resulting from pathological disturbances. In a normal state they are very weak, and escape observation all the more easily because they differ but little in quality and intensity. But, being very numerous and continual, these sensations exercise a great influence over our psychical condition and sometimes indirectly determine the trend of our thoughts and the forms of our feelings. Thus, for example, the vivacity of mental images and ideas often depends on special conditions of organic sensibility. When an image or an idea is in opposition to the preponderant series of organic sensations with which the consciousness is occupied, a conflict takes place in which the image and the idea are nearly always vanquished. It is, for instance, very hard to form a lively conception of the pangs of hunger after having eaten a good meal; for the organic sensations of fullness proceeding

from the stomach blunt the fancy of the opposite. It is observable, likewise, that the feeling of pity is often associated with organic weakness, while strong, healthy, and vigorous men are less inclined to it. It is only possible if we are able to realize a lively representation of physical or moral weakness; but men whose entirely healthful and vigorous organization develops feelings of well-being and strength can form only the poorest conceptions of those conditions of feebleness that are in contradiction to the preponderant system of sensations.

These principles explain why the young, well, and vigorous man concerns himself very little about death, although he knows to a certainty that it is inevitable. In a sound body the organs send unprecise and indefinite sensations to the brain, which, however, all together give that feeling of vigor and physical well-being that might be called the general sensation of organic life. According with the psychological phenomenon we have described, this condition of organic sensibility is diametrically opposed to the production of vivid images of death. The thought of death is therefore vague, feeble, and without consistency in the larger number of minds; and it is not competent to call out very strong feelings or excite a terror that will arouse the instincts of preservation that are slumbering in the depths of the consciousness.

The same principle explains why it is that old people generally are the ones who are most afraid of death and do not like to have it spoken of in their presence. Everybody has observed how worried aged persons are and how they protest if sickness or deceased persons are mentioned; that they are extraordinarily pleased when they read in the papers the accounts that are given occasionally of some centenarian living in some remote district; and what extraordinary precautions they take to preserve their health. We might believe that old men are preoccupied with death so much because they feel it near; but other facts demonstrate that the abstract number of probabilities of dying is not an element of the fear of death. Men in some occupations, as sailors or miners, are continually exposed to the danger of death; but they, especially the youth among them, do not take sufficient thought of it to be disturbed or saddened by it. The greater vividness of old men's conceptions of death is most likely a result of the advancing weakness of their organs and physical sensations.

Man has to face not only the abstract thought of death: he often finds himself confronting the real danger of it. What are his conduct and feelings then? A number of curious facts indicate that violent deaths, provided they are not too slow, are easy and free from pain; it might be said that death excites hardly any horror

when it comes quickly and without previous announcement; so the confessions of some persons who have escaped the gravest dangers would make us believe. Mr. Wallace has recorded some incidents of this kind in his Darwinism, and says of them that those persons who have escaped from the clutches of a lion or a tiger experienced no physical or moral suffering in their peril. Dr. Livingstone describes his feeling when seized and shaken by a lion as a kind of stupor with no pain or terror, although he was fully conscious of what had happened to him; so a chloroformed subject is able to follow the operation without feeling the instrument. Mr. Whymper, when he fell several hundred feet on the Matterhorn, rolling from rock to rock till he alighted on a mass of snow which fortunately held him just clear of the edge of a precipice, although he received a number of contusions, felt no pain and did not lose consciousness, but simply speculated as to the number of tumbles he would still receive before it would be over with.

The questions arise whether the nervous shock occasioned by the accident produces a kind of insensibility which paralyzes, as it were, the feelings of fear and terror, or whether the affair goes on so rapidly that there is no time for the formation of all the complex of images and feelings that culminate in the fear of death. Livingstone's precise observation suggests that there is really a kind of acquired insensibility. His comparison of his condition to that of a subject under the influence of chloroform appears more than probable when we reflect that severe nervous shocks of every kind coming under the form of extremely violent and sudden sensations or emotions produce this sort of hypnotic anæsthesia. It is well known, for example, that if we fall and receive a rude shock we remain for some time unconscious, or at least with a diminished sensibility. The same effect is produced by a sudden affliction, as, for example, a surprise of very bad news; grief does not follow at once, but a kind of insensible stupor with only the most obtuse consciousness of pain and of self. Thus the nervous shock provoked by the tumble over the rocks or by lying helpless under the paw of a wild beast would produce a kind of semi-sensibility, in which the thought of death would present itself just like any other thought without exciting any fear or terror.

Another extremely interesting problem in psychology lies in the study of the thoughts and feelings of the sick with respect to death. Are they preoccupied in the course of their illness with this probable ending? Do they preserve the habitual carelessness of all mankind? What relation exists between the moral character of the patient, between the kind of disease, and the fear of death? I can not fully answer these questions for want of a suffi-

cient number of facts and observations, but will record what I have observed without assuming to give it the value of definite conclusions.

I have been much struck by the fact that patients afflicted with chronic and lingering diseases appear careless about death, and even have often an ardent confidence in life and hope to enjoy it long. The phenomenon is especially remarkable in consumptive patients, although they know well enough that science has no remedy for their disease, and only one of those miracles that sometimes are wrought in the organism can save them. Their belief in a near recovery is sometimes so strong that it takes the form of a real hallucination and a delirium. I can say nothing precise about those who suffer from acute diseases. There are those who remain sick, recover, or die without ever saying a word about death or showing any apprehension of it; others, on the contrary, are desperate, mourn their fate, and exhibit in their talk and acts poignant and profound anguish at the prospect of death. Still others manifest a resigned preoccupation and a regret modified by a Stoic recognition of the inevitableness of death. It is impossible now to say what the causes of these differences are; but the question is an interesting one. A most curious phenomenon is the fact that death sometimes loses its horrible character and is contemplated with real pleasure. Few psychological facts seem more strange and astonishing than this. The ancient Brahmanical custom of burning the bodies of widows with their husbands became almost a moral privilege for the women, and to many of them represented the magnificent ending of a beautiful existence. The attempt of the English to eradicate it was met by a strong opposition from the women themselves. A similar custom, though devoid of the religious surroundings, exists in China, where childless widows believe that they die well if they strangle themselves after the interment of their husbands.

Examples of pleasure in death are found, too, in countries of European civilization. It is true that the most remarkable cases of this kind occur among nervously diseased persons; but as their disorders are generally only exaggerations of normal tendencies, the psychological phenomenon is well worthy of attention. Death is sometimes sought as preferable to a threatened separation under the impulse of a strong emotion of love; and instances are cited in which couples have deliberately and elaborately prepared for it as if for a party of pleasure. Persons have been known to invite death, in the expectation of thereby promoting some scheme of vengeance. Savages of certain tribes who have been offended and have no other means of vengeance kill themselves, believing that their spirits will return to torment their enemy. Under the Hindu

custom of the Dharma, or fast, men starve themselves to death for the sake of annoying their enemies. So persons of disordered nerves among us, or victims of various passions, commit suicide in order to excite remorse in persons to whom they become antagonistic. Others die to gratify their vanity, and surround their death with conditions that will attract attention or that bear a character of sensational display. A great many suicides would probably never commit the fatal act, no matter how hard the miseries of life might oppress them, if they thought nothing would be said of the matter in the press or in society; while, in fact, a supreme satisfaction attends their departure from life in the anticipation of the talk there will be about it.

Persons in certain classes or occupations are attracted by particular modes of death. Thus death on the battlefield possesses a dazzling glamour for soldiers, in whose conception of it there is no thought of terror.

Death may further be made to appear pleasant through the operation of religious or political fanaticism. Multitudes of men have exposed themselves to the most terrible dangers of death, and multitudes of others have actually suffered it, full of enthusiasm and joy, for an idea, and have given themselves up to destruction for it. Such feelings acquire frightful intensity when they become epidemic and are propagated through a mass of people.

Such cases present a strange perversion of the instincts of self-preservation, which are ordinarily the firmest and strongest of our feelings—a contradiction to the most general laws of life so complete and distinct as to make a search for an explanation for it very desirable.

The explanation, we believe, may be found in the laws of association. Association is capable of changing the psychological value of any object, of rendering agreeable a thing that is offensive to another or under other circumstances, or an action by which others are annoyed or to which they are indifferent; and can give precious value to a recollection, a thought, or an image which would be repulsive to others. Such associations operate with striking force in cases where the passion of love is concerned. Associations connected with a place where one has lived are agreeable or disagreeable according as one has been happy or not there; and the law may extend to objects and images of all kinds, and even to the merest trifles.

By the same law we may account for these exceptional eliminations of the repulsive character from the thought of death. When it is associated with intense passion, with the anticipation of glory and fame, or when the gratification of animosities is the dominant

desire, all feelings contradictory of these suffer a total eclipse, and death becomes desirable as a means to obtain what to the passing fancy seems a greater and the supreme end.—*Translated for the Popular Science Monthly from the Revue Scientifique.*

THE SYMBOLISM OF SALT.

By MARIE GOLDSMITH WEST.

DR. WALTER JAMES HOFFMAN, in his paper upon Popular Superstitions, which appeared in the Popular Science Monthly for November, 1896, speaks of the ominous meaning attached to the spilling of salt at table. He traces the origin of this widespread belief to our Lord's Supper and consequent events. Now, this is an erroneous though not infrequent supposition, doubtless generated by Leonardo da Vinci's great picture of the Last Supper, where he represents Judas overturning the saltcellar as he reaches over the table to dip his hand in the dish with our Lord. As a matter of fact, mention of the superstition was made in works anterior to the time of Christ. It was a common belief among the Romans, and may even then have been a survival, since proof exists that this mineral was held sacred very early in the history of the human race.

The Romans began their feasts by prayers and libations to the gods. The table was consecrated by placing upon it the images of the Lares and saltcellars. A family saltholder was kept with great care, and to spill the salt at table was esteemed ominous.*

The prominence of salt as a religious and social symbol is doubtless due to the fact that it became a necessity to most nations at an early stage of civilization, and that it was a luxury very hard for primitive man to obtain in many parts of the world. There are still, even in this era of commerce, portions of central Africa where the use of this mineral is a luxury confined to the rich.

In ancient times and among inland peoples the possession of a salt spring was regarded as a special gift of the gods. The Chaonians in Epirus had one which flowed into a stream where there were no fish, and the legend was that Heracles had allowed their forefathers to have salt instead of fish.†

The Germans waged war for the possession of saline springs, and believed that the presence of salt in the soil invested the district with peculiar sanctity, and made it a place where prayers were most readily heard.‡

* Horace, Od. ii, 16, 14, Test. † Arist., *ut supra.* ‡ Tacitus, *ut supra.*

That religious significance should come to be attached to a substance so highly prized, and in many cases so hard to obtain, seems but natural, especially as the habitual use of the mineral commenced with the advance from nomadic to agricultural life—that step in civilization that is said to most influence the cults of the nations.

So important was salt to the ancients that it has been conjectured that the oldest trade routes were created for traffic in the article. Certainly, with the addition of incense, it plays the principal part in all that is known of the ancient highways of commerce. One of the roads in Italy is the Via Salaria, by which the produce of the salt pans of Ostia was carried up into the Sabine country, and to the present day the caravan trade of Sahara is largely dependent upon salt.*

Of old the gods were worshiped as givers of the fruits of the earth, and especially of bread and salt, which are always mentioned together. This mineral was associated with religious offerings, particularly cereal. Its preservative qualities made it the fitting symbol of an enduring compact; hence, probably, the "covenant of salt," spoken of so frequently in the Bible.

Numbers, xviii, 19: "It is a covenant of salt forever before the Lord unto thee and to thy seed with thee"; and 2 Corinthians, xiii, 5: "Ought ye not to know that the Lord, the God of Israel, gave the kingdom over Israel to David forever, even to him and to his sons by a covenant of salt?"

These verses illustrate the importance attached to such compact. Not only were the gifts bestowed, but they were made enduring by "a covenant of salt."

In the mountains of Salzburg, about 1730, there existed what was known as the "Salt League of God." Menzel gives an account of the ceremony from which the association derived its name: "Each confederate on taking the oath dipped his finger in the saltcellar, and from this circumstance and the allusion it contained to the name of their country the league was styled by them the 'Salt League of God.'"

The Mexicans personified their veneration for salt in the goddess Huixtocilmatl. She was said to be a sister of the rain gods, with whom she quarreled; in their resentment they drove her into the salt water, where she invented the art of panning the mineral, and became the goddess of salt.†

Next to its religious significance salt was, above all, the symbol of friendship. To eat salt with a man was held by most peoples, the Orientals especially, to form a sacred tie of brotherhood. Any per-

* Also see Herodotus's account of the caravan route uniting the salt oases of the Libyan Desert.

† Bancroft. Works on Native Races.

son who had the hardihood to disregard this obligation would have been considered a social pariah of the vilest description. In the Forty Thieves, Cogia Houssain refuses to go to table with his intended victim for fear he should partake of this sacred substance in his company, and thus be compelled to forego his plans. When hard pressed for his reason, he makes excuse for not accepting the proffered hospitality by saying, "I never eat of any dish that has salt in it." There is an allusion in the Arabian Nights (Burton's edition, I believe) to a robber who, wandering about in the dark in a strange house, stumbles on a small, hard object.. In order to ascertain its nature he puts it to his lips, and, discovering it to be salt, is compelled to abandon his burglarious intentions because, since he has tasted salt beneath that roof, he is forced to respect its master's property.

Omar Khayyam refers to the symbolical meaning attached to the mineral in the following lines:

> "O wheel of heaven! no ties of bread you feel,
> No ties of salt, you flay me like an eel!"*

There were a number of other social usages connected with this mineral, from which have arisen various customs, superstitions, and representative expressions.

In ancient times it was customary to place the saltcellar in the center of the table. Above this sat the superiors, and below the inferiors; hence the expressions, "above the salt," "below the salt." Jonson, in Cynthia's Revels, illustrates their application: "His fashion is not to take knowledge of him that is beneath him in clothes. He never drinks below the salt."

Salt is also symbolical of wit, of sarcasm, of the good things of life, as—

> "I never drank of Joy's sweet cordial
> But Grief's fell hand infused a drop of gall;
> Nor dipped my bread in Pleasure's piquant salt,
> But briny Sorrow made me smart withal."†

Another well-known expression—i. e., "To be worth one's salt"—doubtless owes its origin to an old custom that obtained in more than one part of the world—that is, using cakes of salt as money—for instance, in Abyssinia and elsewhere, in Africa and in Thibet, and adjoining parts.‡

In Colonel Yule's translation of Marco Polo, he devoted a note to the use of salt as a medium of exchange in the Shan markets down to our own times. Also in the same work details are given as

* Quatrains of Translations. E. H. Whinfield.

† Omar Khayyam. Translation by E. H. Whinfield. ‡ Marco Polo, book ii, chap. xlviii.

to the importance of salt in the financial system of the Mongol emperors. The substance stood as well for costliness, as, "He paid a salt price for it."

Another ancient practice connected with salt is alluded to in the Bible, Ezekiel, xvi, 4: "Thou wast not salted at all."

This refers to the custom of salting the skin of newborn babes. The operation was supposed to make the epidermis dry, tight, and firm. Galen speaks of the practice. It may also have been emblematic of purity and incorruption.

Superstitions concerning salt are widely scattered over the world. When the Chinese observe the last festival of the year, literally called "rounding the year," a portion of the ceremony consists in building a bonfire of pine wood before the ancestral tablets of the family. Upon the flames salt is thrown, and the crackling which it occasions is regarded as an omen of good luck for the following year.*

The mountain people of North Carolina and West Virginia are said to put salt in their shoes in order to keep off the witches. Bancroft related that one of the aboriginal tribes of North America refrained from eating salt in the belief that it turned the hair white.

Several curious customs, founded upon the ancient religious significance of salt, survived until a recent date. Such was the Eton Montem, or procession of the "Eton" boys to Salt Hill. Certain boys in fancy costumes went first, in order to levy contributions on the passers-by. These donations were devoted to the maintenance of their captain at college, and all who gave received a pinch of salt in return. Another well-known college custom, that of salting the freshmen before they were entitled to join in games with the others, may have had something to do with the naming of the new students; or it may, on the other hand, have been instituted as a boyish joke because of the name already given.

Though in some portions of America salt was introduced by Europeans, yet there were many parts where the mineral was accessible, and a number of native tribes besides the Aztecs held it in high veneration. One of the professors who recently visited the Zuñi villages on behalf of the Smithsonian tells of a curious custom of the people which, I believe, has not been published hitherto. The Zuñis, when organizing an expedition to go after salt, fit out a war party and take provisions greatly in excess of their wants for the time during which they will be gone. Since there is no object to be served by a war party in times of peace, it has been conjectured

* Social Life of the Chinese. Justus Doolittle.

that this practice is a survival from the days when the Zuñis were inhabitants of the cliff dwellings. By careful computation it has been ascertained that the amount of provisions invariably carried would be the proper allowance for the time consumed in a journey from the cliff dwellings to the place where the salt is obtained and back again.

From the careful preservation of all its features this salt-getting expedition would appear to have been at one time a ceremonial of religious importance. In the old cliff dwellings are found peculiar little bags containing salt; and at the present time a certain amount of the mineral, when brought to the villages, is set aside as sacred and preserved in little bags almost identical with those found in the ancient dwellings.

Where men live on milk and raw or roasted flesh, sodium chloride is an unnecessary addition. Thus the Numidian nomads in the past did not, and the Bedouins of Hadramant of the present do not, eat salt with their food. On the other hand, a cereal, vegetable, and boiled meat diet calls for salt. Livingstone's South Africa contains a very interesting passage treating this subject. The author says, speaking of the Bakwains: "When the poor who had no salt were forced to live on an exclusively vegetable diet they were troubled with indigestion. The native doctors, aware of the cause of the malady, usually prescribed some of that ingredient with their medicines. The doctors themselves had none, so the poor resorted to us for aid. We took the hint, and henceforth cured the disease by giving a teaspoonful of salt, minus the other remedies. Meat or milk had the same effect, though not so rapidly as salt. When I was myself deprived of salt for four months at two distinct periods, I felt no desire for the condiment, but was plagued by a longing for meat and milk. This continued as long as I was confined to exclusively vegetable diet, and when I procured a meal of flesh, though boiled in fresh rain water, it tasted pleasantly salt. Milk or meat or salt, obtained in however small quantities, removed entirely the excessive longing and dreaming about roasted ribs of fat oxen and bowls of cool, thick milk."

The consumption of salt has become almost a necessity to most peoples through long-continued habit; but, where tribes have been cut off from the use of it for a lengthened period, the taste for the mineral has almost or entirely died out. For instance, during the reign of Montezuma I, and from that time to the conquest, the Tlascaltec territory was completely surrounded by the Aztecs. Thus communication with the coast was prevented, and this people were compelled to dó without salt among other luxuries. It became so rare that, though the nobles smuggled in a little for their own use,

the condiment became quite unknown to the common people, who quite lost their taste for it.*

In Pliny's time salt was considered a valuable medicament for various ailments. It was taken to neutralize the effects of opium, and above all it was valued as a cure for leprosy.

The most common artificial salt is made by evaporating sea water in salt pans. It is also produced by pouring salt water upon burning wood, the ashes of which are said to have almost the pungency of the true mineral. When thus prepared the salt is black. In Arabia, according to Pliny, so many salt mines were found that people resorted to them instead of quarries, building whole houses and even cities of this mineral. Gerrah was entirely composed of it.

One of the most remarkable salt mines in the world is at Wieliczka, near Warsaw, Poland. It has been worked since 1252, and at one time furnished the principal revenue of the kingdom. A vast number of people inhabit the subterranean passages of this mine, and are governed by laws and magistrates of their own. Each miner is allotted a little cell, where he dwells and rears his family. As many as eighty horses are kept in this underground republic to carry to and fro along the immense corridors which are supported by pillars of salt. When the light falls down the long vistas it makes the mine look like a crystal palace, of which the walls and pillars are tinged with delicate green.†

OUTSIDE of the timber belt, which begins at Monterey and extends at intervals to Oregon, there is hardly a mountain on the Coast Range of California, from San Diego, on the south, to Trinity, almost at the Oregon line, says Carl Purdy, in Garden and Forest, which is not in part covered by the chemise brush, or chemisal. The greater the distance from the ocean the larger the percentage of mountain lands which this hardy shrub has taken possession of, until many sections of the eastern part of the Coast Range are almost given up to it, and from the valleys to the mountain tops it holds a sway only shared by a few of the hardiest shrubs, oaks, and conifers. Hardly a spot is too steep to allow it a foothold, hardly a soil too meager to afford it sustenance. Fires sweep over and leave blackened stubs, but with its unusual vitality it soon starts a new growth. In a few years rocks, hills, and slopes are again masked by a close color of blue green, which gives to the mountains a softness of outline peculiar to the Coast Range, and very beautiful too, although the monotony of flowing lines often becomes tiresome. The chemise (*Adenostoma fasciculatis*) is of the rose family, and is an evergreen with linear, heathlike leaves, a light-colored, stinging bark, and brittle wood. In late spring it produces an abundance of whitish flowers with green centers.

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* Bancroft. Works on Native Races. † Valmont de Bomare, tome v, p. 591.

THE TEACHING OF APPLIED SCIENCE.

By M. CH. LAUTH.

IN an article published a few months ago in the *Revue Scientifique* I pointed out a danger that threatens some of our chemical industries. I showed on the evidence of official documents that these very industries have taken a rapid start and had an immense development in Germany, while they have continued nearly stationary in France, the country of their origin. In the search for the causes of this standstill I believe I established that it is largely due to deficiencies in the chemical instruction given in France and to the indifference to industry manifested by our scientific men, while in Germany the teaching of chemistry has reached an admirable stage of perfection, and the alliance of science and industry is commended as a necessity of the first order. Like ideas have been developed recently in various publications; attention seems to be concentrating around the question, a happy sign which I remark with joy. M. Léon Lefèvre, who agrees with me in opinion on this point, speaks of the parallelism in the development of the color-making industry and of organic chemistry in Germany. "That country," he says, "now possesses the supremacy in both, and yet it did not assist at the birth of artificial coloring matters; for the honor of the discovery of the first aniline colors belongs to France and England"; and he calls attention to the very rapid growth of the Chemical Society of Berlin since that discovery was made in 1868 from 107 members to 3,129, as compared with that of the societies of London, 551 to 2,029, and of Paris, 269 to 736. M. Haller, director of the Chemical Institute of Nancy, presents a similar argument, and quotes Humboldt's prediction that those countries which neglect recourse to their scientific lights will see their prosperity inevitably jeopardized as neighboring nations develop and strengthen themselves under the vivifying influence of the arts and sciences. My opinion is further sustained by many other men of science from whom I have received letters. Some of them accuse our method of teaching, which, they find, has no direct bearing on the object for which the instruction should be given. One of them says it is all wrong, in that it gives prominence to the abstract and does not give importance to the application, and another finds fault with the method by which instructors are chosen and appointed.

We may look at the subject from another side and inquire whether manufacturers have done their best to keep their standards even with the highest. It will appear that the majority of French manufacturers do not appreciate as they ought the influence of sci-

entific work on the development of industry and the fatal repercussion which this incessant progress going on in the domain of pure science inflicts upon it. They therefore content themselves with improving their old methods and processes. Instead of inviting the co-operation of men of science and expert chemists, they continue to intrust the fate of their machines to simple overseers, capable enough of adjusting a machine of the old style, but incapable of devising a new process. Sometimes, it may be, they trust to some happy accident to help them against foreign competition and restore prosperity to their establishments without reflecting that the success of their rivals is exclusively owing to their strong scientific organization.

If, with a more enterprising spirit, they call in men of science to co-operate with them, they are most likely to expect an immediate return and to be discouraged if they fail to realize it; and dismiss their advisers because they can not perform the impossibilities they expect of them. Hence the sad misunderstanding which exists between men of pure science and manufacturers, the former repeating that industry offers no opening for their pupils and that it is of no use to direct them to a career that is ungrateful to them, and the latter affirming that they do not find among the chemists they employ the knowledge that will render their collaboration fruitful.

Misunderstandings of this kind will continue so long as professors charged with the direction of chemical studies do not take exact account of what will be expected of their students when they go into industrial occupations. It should be well understood that the manufacturer does not expect to find master workmen or good overseers in the chemists he engages. No one is capable of directing a factory without having followed for a considerable time the course of the several shops. This is not the part the chemist is to perform; nor is it his duty to keep an eye upon the workmen. He must first of all things—and it is an absolute condition—be in the current of the science, and more especially, of course, of the parts of the science that treat of the industrial branch to which he applies himself. He should be familiar with all the details of mineral analysis, qualitative and quantitative, of organic analysis and industrial analyses; and be skillful in delicate manipulations and preparations. He should be acquainted with what is required in the principal chemical industries and familiar with the most practical general methods in use for solving the problems that will be submitted to him, to such an extent as to be competent to improve in quality and value the manufactures which he will be charged with inspecting and perhaps directing. And he should, finally, have a taste for original research,

and be able ultimately to take advantage of his theoretical knowledge, so as to aspire to make discoveries that will place him in the rank of inventors—the dream of every chemist of any ambition. The young student who presents himself in industry with such a supply of knowledge will be sure to find for himself a most honorable place at once, and will have every encouragement to continue his studies for a year or two longer rather than present himself insufficiently equipped; for once in conflict with the daily difficulties inherent in every exploitation he will have no more time to learn.

It is not necessary to say that the "ideal" chemist does not exist in France, and with the kind of teaching that is given can not exist. Young men may indeed be found possessing a remarkable stock of theoretical knowledge and in every way capable of brilliantly sustaining their graduating theses, and some can even perform a mineral analysis or an organic analysis correctly. But I do not think I am too severe when I say that I believe that further than that they have only the vaguest smattering—and there is nothing surprising in that, for nobody has taught them more. For this I do not blame the science of the masters or the motive of the students. The teachers have not had their attention directed toward industrial affairs, and have not therefore been able to teach their students with reference to them.

The reform we need can not be introduced by the personal initiative of the students; for even if they should awake to the necessity and turn their minds to industrial research and the acquisition of practical knowledge available in the shops, they are powerless so long as they have to prepare for the examinations. Might we hope that the manufacturers should be disposed to favor special laboratories for the training of industrial chemists? Their effort would invoke our sympathy, but it would be many years before it would yield results; and all that time our rivals would be gaining on us.

The best remedy, it seems to me, is to look to the existing schools for measures to improve their methods and give their teaching a more practical, more industrial direction. Since I first called attention to this subject in 1878 a number of schools have been established where chemistry is specially and practically taught; but the results they yield will, I fear, always be incomplete so long as the direction of them is intrusted to purely scientific men. However eminent they may be, they are not familiar with what is wanted in chemical industries, and they can not familiarize themselves with it except by placing themselves in constant relations with the heads of great manufactories and studying their requirements, as is done everywhere in Germany.

A reform of the kind sought could be brought about without

great expense by incorporating upon the present programme systems of lectures and of manipulations; the lectures to consist of the exposition of the principal chemical industries, and the laboratory work of industrial preparations and applications; and the students should be exercised in comparing manufactured products and in studying the general methods pursued in industrial research, the processes adopted for increasing returns, and other branches of similar bearing. Such instruction demands special fitness—teachers who are familiar with industries and love them. That is the basis of the reform I propose. In order to teach the applications of science, to make known the methods, processes, and desiderata of industry, one must have studied and practiced them himself. He must himself have been a workman. Whatever may be the value of our masters, however great may be their intelligence, they can not develop knowledge in the minds of their pupils that is foreign to themselves, or make them adopt methods of labor which they have never themselves seen applied.

I have already received protestations from the teaching body against seeing men raised to the dignity of professors or lecturers—men who have not their diplomas as licentiates or doctors in science. But I really do not believe that the possession of these diplomas is indispensable to the purpose toward which I am looking; and I fancy that for the treatment of industrial questions it is sufficient to understand them for one's self.

The teaching of which I have thus sketched the programme might be given at the close of the studies of our young chemists and constitute the crowning of them. The reform I propose consists, then, simply in opening our chemical schools and institutes to lectures and manipulations in applied chemistry, and in confiding this special teaching to professors who have themselves been engaged in industry.—*Translated for the Popular Science Monthly from the Revue Scientifique.*

IT has long been a question how the priestly office became so associated with bridge-building that that function should have given their principal official titles (*pontifex, pontiff*) to the Roman chief priest and the Pope. An attempt at an explanation is made by Herr Rudolph von Ihering, in his Evolution of the Aryans, who says: "All the branches of the pontifical duties may be traced back to the original demands laid upon the technical bridge-makers of the migratory period; their priestly office, to the necessity of the expiatory sacrifice to the river god, which could not be offered by the *Flamens*, who were the priests of the national divinities only; their skill in writing, to the drawing of the plan of the bridge; their chronology, to the estimation of the proportions of the bridge; their relation to the law, to the claim of the river god upon the bridge toll."

THE LIFE HISTORY OF SCIENTIFIC IDEAS.

By M. GUSTAVE LE BON.

SCIENTIFIC ideas are subject to the same general law of evolution which we have expounded as to other ideas in a previous paper (The Work of Ideas in Human Evolution, Popular Science Monthly, vol. xlviii, August, 1895); but being less lasting than other ideas, the study of them is easier. Science does not escape the general laws that regulate the elements of every civilization. These laws, too, are derived from a small number of fundamental ideas variable in different epochs, and which stamp a deep mark on every science. All modern physics rests upon the idea of the indestructibility of energy; biology on the idea of transformation by selection, and pathology on that of the action of the infinitely little. It is a property of scientific ideas that they have a force much less relative than that of religious, political, and moral ideas, but they lack much of being absolute truths; and that is why we see the directing ideas of science usually changing every fifty years. All these ideas are most frequently nothing but provisional hypotheses. The only veracious side of them is that they explain for the given moment the largest number of the facts. Darwin's hypothesis of the evolution of living beings explains more facts than Cuvier's hypothesis of successive creations; and the hypothesis of luminous undulations explains more phenomena than the hypothesis that preceded it.

It does not matter that these great directing ideas are erroneous. If we place ourselves at the point of view simply of the advance of the human mind, it will hardly be a too rash assertion to say that error is infinitely more useful than truth. Absolute truths, or what are considered such, are not discussed any more and provoke no investigation. Ideas held as hypotheses, on the other hand, provoke much. The researches made for the purpose of defending or attacking the hypothesis of the emission of light and that of undulations begat the finest discoveries of optics. The much-debated hypothesis of transformism has produced more research within a few years past than was made in all the centuries gone before. During the epoch, on the other hand, when what Aristotle and Ptolemy wrote was held for gospel truth, there could be no research; and for several centuries science was contented with traditions and made no progress. The most fruitful method of investigation is by imagining some hypothesis and trying to verify it, and by modifying it as new facts come to light. The great advantage of scientific ideas is that their value can be speedily ascertained by experiment, while that of re-

ligious, political, and moral ideas is determined very slowly. We should not, however, suppose that they are established and vanish with any extreme rapidity. Their evolution is indeed more rapid than that of other ideas, but it follows the same phases. Its history shows that although they address themselves only to the most enlightened minds, it takes them not less than twenty-five years, and usually much longer, to establish themselves. The clearest of them, the least hypothetical, those most easy to demonstrate, those which would seem least subject to controversy, like the doctrine of the circulation of the blood, have not been accepted in less time. In other respects scientific ideas are established under the influence of the factors we have described as acting with other ideas—affirmation, repetition, contagion, and prestige—and perhaps we may add, since we are dealing with the scientific category, reasoning; but the action of this factor is so weak that we might properly omit it. When it intervenes it is chiefly to refute an accepted idea, not to establish a new one. The new scientific idea is rarely imposed, so far at least as the majority of minds are concerned, by demonstration. It must not be supposed that because a man cultivates science he is released from the yoke of established dogmas. Scientific dogmas are often the most tyrannical of all.

The scientific idea is pre-eminently established by the prestige of the man who imposes it, and rarely in any other way.* When Charcot introduced to science the phenomena of animal magnetism, which had been described for more than a century by students whose only fault was that they had no prestige, and whose admirable researches had been neglected for that reason by many generations of doctors, shall we suppose that the demonstrations of the professor were what convinced the medical public? Not at all, for the same demonstrations had been repeated thousands of times within a hundred years. The conviction was simply the result of the prestige of the expert, who did nothing but introduce into official science a series of phenomena which were perfectly known before him. After having been established by prestige the scientific idea goes through the

* It might be objected to this assertion that Darwin, who was without title, claim, or authority, had no prestige when he made his investigations. But it would be easy to answer, first, that his example is almost unique; and, second, that Darwin's doctrine was supported in England, as soon as it appeared, by men who had much prestige. I am, moreover, not sure that if Darwin had been born in one of the countries where mental worth is exclusively measured by the number of decorations it wears, the immortal book, the Origin of Species, would never have found a reader. The author would soon have been made to understand that, not being an academician or professor, he could only make himself ridiculous by taking up questions which had been long treated by the most illustrious specialists.

regular course of evolution. It is taken up by apostles who propagate it in a small circle, and it begins to spread. It at first meets with strong opposition, for it strikes forcibly against many ancient and established things. The apostles who have adopted it are excited by this opposition, which only persuades them of their superiority over the rest of men, and they defend it with energy, not, indeed, because it is true—for they generally know nothing about that—but simply because they have adopted it. The new idea is discussed and is accepted in whole by some and rejected in whole by others. Affirmations and negations are exchanged, but very few arguments; the only motives for the reception or rejection of an idea being, for the immense majority of minds, simply those of feeling, in which reasoning has no part. In consequence of these passionate contestations the idea progresses slowly. The young people who become aware of the contest adopt the idea readily, for the single reason that it is contested. To youth, eager to be independent, wholesale opposition to things that are accepted is the most easily accessible form of originality. The idea therefore continues to gain. As it is gradually accepted by official men of science it at length becames propagated wholly by the mechanism of contagion, and insinuates itself, timidly at first, and then boldly, into the classical books. Its triumph is then complete. Like religious dogmas, it becomes a part of the things that are not disputed. We have only to recollect the history of transformism in France, and how the scandalous heresy has passed into the state of a classic dogma, to observe the successive series of these phases of propagation.

After having prevailed for a considerable length of time the idea begins to lose its hold and at last dies out. But before an old idea is wholly destroyed it has to go through a series of retrogressive transformations that require many generations for their accomplishment. Before vanishing forever it takes its turn in forming a part of the old hereditary ideas which we qualify as prejudices, but respect nevertheless. The old idea, although it is already nothing but a word, a sound, a mirage, possesses a magical power that still subjects us. At last it dies. After reigning long over a civilization ideas lose their prestige, fade away, and are extinguished. New discoveries disturb them. Belief in them becomes less general. Men begin to discuss them, and by the mere fact of discussion their death is near. Every great directing idea being generally a fiction, they can not submit to be discussed except on condition of never being subjected to critical examination. But even when an idea has been violently disturbed the institutions derived from it retain their vitality and are effaced very gradually. When it has completely lost its

power all that it upheld soon falls. It has not yet been given to any people to change their ideas without being at once forced to transform all the elements of their civilization.—*Translated for the Popular Science Monthly from the Revue Scientifique.*

SKETCH OF JOSEPH PRESTWICH.

SIR JOSEPH PRESTWICH was, at the time of his death, the oldest of British geologists. While his scientific honors were numerous, the formal recognition by his Government of the value of his work, much of which had redounded greatly to the material advantage of England was tardy. It came to him in the form of a complimentary knighthood only on the New Year's day before his death in the following June, when he was not able, on account of feeble health, to accept it in person from her Majesty. Till 1872 Dr. Prestwich curiously combined the two occupations of wine merchant and geologist. His business took him frequently to France, and while there he sought and improved the opportunities he found to make geological studies of the districts he visited; and it is told of him that his friends used to like to go geologizing with him on the other side of the Channel, "as his walks generally ended in the pleasant château of some vine-grower."

JOSEPH PRESTWICH was born in Clapham, England, March 12, 1812, and died in Shoreham, Kent, June 23, 1896. He was taught at London and Paris, and in Dr. Valpy's Grammar School in Reading, and afterward studied at University College, Gower Street, London, where he gave special attention to chemistry and natural philosophy under Prof. Edward Turner and Dr. Dionysius Lardner. There also his attention was first drawn to geology and mineralogy, which were among the subjects in Turner's course. After he went into business he continued to devote all the leisure he could command to the study of geology, first as a means of relaxation and afterward on account of the scientific interest he took in it.

He began publishing scientific papers in 1835, when he was about twenty-three years old, his first, on the Ichthyolites of Gamrie, Banffshire, Scotland, having been printed in the Transactions of the Geological Society of that year, and some of his earlier papers on the Coalbrookdale Coal Field being of the same period. Other papers followed in the Quarterly Journal of the Geographical Society on Structure and Organic Remains of the Tertiary Beds of the London and Hampshire Basin, in which many now fully accepted facts of geological sequence and relations were first established. In these

researches he paid special attention to the lithological changes of the strata and to the fossils. In consideration of this earlier work he was awarded the Wollaston medal by the Geological Society.

Having acquired some familiarity with the geology of France by his former residence as a student and his frequent business there, Mr. Prestwich, in the course of the studies which resulted in the rearrangement of the Tertiary formations, carried his explorations across the Channel to the corresponding formations of France and Belgium, for the purpose of determining the correlation of the strata. In the course of these investigations, at the suggestion of Dr. Hugh Falconer, and in company with Sir John Evans, he examined the valley gravels containing flint implements—works of man—associated with the remains of extinct animals, the discovery of which in the valley of the Somme had been announced by M. Boucher de Perthes without attracting special attention. The finds made here could be compared with the somewhat similar discoveries made in England in Kent's Cavern by McEnery and in Brixham Cave in 1858. All these evidences of man's antiquity, together with others subsequently found in England, were studied by Prestwich and Sir John Evans, with the result of fully establishing the contemporaneous existence of man with other Pleistocene mammals. The question of the duration of man's existence upon the earth thus became a subject of lively discussion, which still continues. The theory of man's extreme antiquity, as indicated by these remains, which Mr. Prestwich was inclined to embrace at the time, and which he was among the first to promulgate in England afterward, underwent a process of modification in his mind, and he was disposed in his later works to reduce considerably the estimates he made then. In recognition of his work as one of the pioneers in establishing the geological antiquity of man, the Royal Society in 1865 awarded him the Royal medal.

As Dr. Prestwich grew older he paid more and more attention to economic geology, and finally became one of the most eminent authorities in that branch. His earlier studies on Coalbrookdale and the Tertiary strata seem, in the light of after developments, to have been preparatory, though unconsciously so, for such a career. A lecture on the geology of Clapham—The Ground Beneath Us—delivered about forty years ago to a local society, and his publication on the water-bearing strata of the country around London, were in that direction. The former work "has stood the tests of time remarkably well," and the latter, first published in 1851, has become a standard, and has lately been reissued with appendices. He was engaged upon the Royal Commission on Metropolitan Water Supply and upon the Royal Coal Commission, to the reports of which he

contributed valuable papers, one of them embodying the conclusion that the coal fields under the Secondary rocks of the south and southeast of England might extend from Somersetshire to the neighborhood of Folkestone, which has been confirmed by borings at Dover.

Dr. Prestwich retired from business in 1872, and in 1874 became professor of geology at Oxford. He continued his researches with his accustomed activity, and enriched the literature of geology from year to year with numerous valuable and original contributions, in the form of papers and addresses to learned societies, in connection with which his name constantly appears, and of books which are indispensable to the thorough student of the science.

Dr. Prestwich's annual address as president of the Geological Society in 1872 gives an admirable statement of the purposes of geological research with reference to the advent of man, and further on of its practical applications to the questions of water supply and coal. Among the theoretical problems that were then occupying the attention of geologists of all nations, the speaker said, were the phenomena connected with the prevalence of great and exceptional cold immediately preceding our time, the first dim appearance of man, his association with a race of great extinct mammalia belonging to a cold climate, the persistent zoölogical characteristics of man as contrasted with the variable animal types presented in geological time, the search for connecting links, and the measure of man's antiquity. Allied to these were the great questions relating to the forms of the continents—the elevation of the land, the origin of valleys and plains, and all that prepared the globe for the advent of man. Further, geology dealt with the requirements of civilized man, "showing him the best way of providing for many of his wants, and guiding him in the search for much that is necessary for his welfare. The questions of water supply, of building materials, of metalliferous veins, of iron and coal supply, and of surface soils all come under this head and constitute a scarcely less important although a more special branch of our science than the paleontological questions connected with the life of past periods, or than the great theoretical problems relating to physical and cosmical phenomena." Proceeding to consider the geological questions connected with water supply, the author suggested that the site of a spring or the presence of a stream determined probably the first settlements of savage man; and his civilized descendants, until the last few years, equally depended upon like conditions. These conditions were connected with the rainfall and with the distribution of the permeable and impermeable strata forming the surface of the country. Under ordinary circumstances few large towns had arisen except where a localized water supply was easily accessible, where

the catchment basin controlling the volume of the rivers was large, and where permeable strata prevailed. Thus it was with London, and the extension of that city had worked along in those directions where water was got with the best facility. The second part of the address related to the work of the Royal Commission to examine into the coal fields and the coal supply, under which Dr. Prestwich was charged with the study of the districts covered by the later Secondary and the Tertiary strata, with the special object of inquiring "into the probability of finding coal under the Permian, new red sandstone, and other incumbent strata. The discussion of this subject implied a survey of the coal fields of England, France, and Belgium, and the possible connection through strata underlying the formations named. Several regions were indicated where trials for coal might be made, which it was admitted, however, might be attended with considerable uncertainty. But whether successful or not as to coal, such trials near London could hardly fail of some important results; for it was "possible that the lower greensands would at some spots be reached, so that the inestimable additional benefit of a large and steady supply of pure water might also be obtained, and with proper care to prevent interference might be maintained for all time."

Commending Dr. Prestwich's investigation of the sources of the water supply of London, and the presentation of the results in his book on that subject—"a masterpiece of minute observation and close and accurate reasoning"—Prof. J. W. Judd observed that the geologist could point to the work "with pardonable pride as affording convincing proof that his science has now acquired a character for exactness analogous to that which is justly regarded as the crowning attribute of astronomy." His predictions as to the finding of coal underneath the Secondary rocks across the kingdom were likewise justified in the results of borings made near Dover.

An important practical application of Dr. Prestwich's investigations of the geology of the English Channel, not anticipated when they were begun, was illustrated in his report on the subject to the Institution of Civil Engineers, presented in December, 1874. This report was described by Nature as being a most excellent example of the indispensability of thorough scientific research as a basis for the useful arts, and of the way in which the highest practical results unwittingly follow from such investigations—made in abstract inquiry, the only end of which was thorough knowledge of the subject in all its scientific aspects and relations. This study of the strata underlying the Channel—an almost perfect example of close and careful reasoning on physical facts—was now brought forward to enlighten the projectors of a tunnel between England and France

as to the nature of the material on which they would have to work; but Dr. Prestwich had distinctly stated that the various formations were considered "irrespective of their relative merits in any other than a geological point of view." His plan had been to discuss carefully all the strata underlying the Channel, from the London clay down to the Palæozoic series, and deduce his conclusions as to the fitness of each formation for being pierced by a tunnel. The investigations on which the paper was founded were mostly undertaken from no practical point of view and before a Channel tunnel was thought of.

Dr. Prestwich's inaugural address as professor at the University of Oxford, in January, 1895, was on the Past and Future Work of Geology. We had no reason to suppose, he held, that during the greater part of the geological periods life in one form or another was not as prolific, or nearly so, in the British areas as at the present day. We might thus form some conception of how little relatively, though much really, we had so far discovered, and of how much yet remained to be done before we could re-establish the lands and seas of each successive period, with their full and significant populations. This we could not hope ever to succeed in accomplishing fully, for decay had been too quick and the rock entombment too much out of our reach ever to yield up all the varieties of past life; but, although the limits of the horizon might never be reached, the field could be vastly extended; each segment of that semicircle might be prolonged we knew not how far; and it was in this extension—this filling up the blanks in the life existing in each particular period—that one great work of the future lay. The speaker then considered two objections which had been urged against what had been called the cataclysmic theory in opposition to the uniformitarian theory—both terms characterized as objectionable in their exaggeration: one, that we required forces other than those which we see in operation; and the other that it was unnecessarily sought in that theory to do by violent means what could be equally well effected by time. The question raised in this theory is not, however, as to the nature of the force, but as to its energy; not a question of necessity one way or another, but of interpretation, of dynamics and not of time; and we can not attempt the introduction of time in explanations of problems the real difficulties of which were thereby more often passed over than solved. Time might and must be used as without limits; there was no reason why any attempt should be made either to extend or control it; but while there was no need for frugality, there was no reason in prodigality. After all, it would be found that, whichever theory was adopted, the need would not be very difficult. The mountain range, for the gradual

elevation of which one would ask one hundred thousand years, the other might require for its more sudden elevation a force which had taken the same number of years to accumulate its energies.

Discussing in the Geological Society in 1889 the distribution and probable age of some palæolithic flint implements, Professor Prestwich maintained that the removal of the material observed indicated the existence of agents of greater force than those operating under the present river *régime*. This closed up the time required for the completion of the great physical phenomena, though the author's inquiry tended to carry us further back geologically than was usually admitted.

In a paper read at the British Association in 1881 on the causes of volcanic action, Professor Prestwich presented objections to the generally accepted theory of Scrope that eruptions are a phenomenon of steam, and held that water, instead of being a primary was only a secondary cause of them—the primary cause being the rolling up of the lava in consequence of pressure due to a slight contraction of the earth's crust. The contact of this fluid lava with the water stored in the crevices is followed by a flush of steam, and this by an influx of water from underlying strata. These are converted into steam and expelled, and the exhausted strata serve as a channel for the influx of sea water into the volcano. A point is finally reached when by the cessation of the shocks and excessive drainage the flow of lava is effected quietly. A paper on Regional Metamorphism, read to the Royal Society in 1885, presented a theory that there exists, in the compression and motion of the strata which have always accompanied the upheaval of mountain chains, a true cause for the development of an amount of heat sufficient to produce one form of metamorphosis—a form which can affect only particular regions—and he would, therefore, in order to distinguish it from contact and normal metamorphism, designate it as regional metamorphism.

Some of Professor Prestwich's later views respecting the Glacial period were presented at a meeting of the Geological Society in May, 1887, when, after showing how the discoveries in the valley of the Somme and elsewhere, twenty-eight years before, had led geologists who had previously been disposed to restrict the age of man to exaggerate the period during which the human race had existed, he proceeded to discuss the views of Dr. Croll on the date of the Glacial period. In view of the recent observations in Greenland of Professor Helland, Mr. Steenstrup, and Dr. Rink, showing that the movement of ice in large quantities was much more rapid, and consequently the denudation produced was much greater than had formerly been supposed, he was disposed to limit the duration of the Glacial epoch to from fifteen to twenty thousand years, in-

cluding in the estimate the time in which the cold was increasing, or Preglacial time, and that during which it was diminishing, or Postglacial time. Details were given to show that the estimate of one foot on an average being removed from the surface by denudation in six thousand years, on which estimate the hypothesis that eighty thousand years had elapsed since the Glacial epoch was founded, was insufficient, as a somewhat heavier rainfall and the disintegrating effects of frost would produce far more rapid denudation. It was incredible that man should have remained physically unchanged during so long a period. At the same time, evidence that had been brought forward of the occurrence of human relics in Preglacial times had led the author to change his views as to the age of the high-level gravels in the Somme, Seine, Thames, and Avon Valleys, and he was now disposed to assign these beds to the early part of the Glacial epoch, when the ice sheet was advancing. This advance drove the men who then inhabited western Europe to localities which were not covered with ice. Man must, however, have occupied the country but a short time before the land was overwhelmed by the ice sheet. The close of the Glacial epoch, or the final melting of the ice sheet, might have taken place between eight and ten thousand years ago.

His latest and most matured views on this subject, agreeing substantially with these expressions, were embodied in his book, Geology: Chemical, Physical, and Practical, which was published in 1886 and 1888. In these volumes he gave more positive expression to the view which had been for some time assuming shape with geologists, and the acceptance of which had been made imperative by the results of geological surveys in America, that, while the great time divisions of geology may be of almost universal application, the smaller breaks in continuity, which are of frequent occurrence in all areas, are subject to constant differences of extent and value. Consequently, in filling up the details of the several geographical areas, each one is found to have its own local stamp, and possesses its own special terms, some knowledge of which is as essential to the geologist as the language of a country is to the traveler, if he would pass through it with profit.

In the preface to this work Professor Prestwich gave a clearer definition of his attitude toward the different schools of geological thought, observing that the doctrine of non-uniformity must not be confounded with reliance on catastrophes, and that it does not involve any questions respecting uniformity of law, but only those respecting uniformity of action. "I myself," he says, "have long been led to conclude that the phenomena of geology, so far from showing uniformity of action in all time, present an unceasing series of

changes dependent upon the circumstances of the time; and that while the laws of chemistry and physics are unchangeable and as permanent as the universe itself, the exhibition of the consequences of those laws in their operation on the earth has been, as new conditions and new combinations successively arose in the course of its long geological history, one of constant variation in degree and intensity of action."

In a lecture at the Victoria Institute in 1894, and in his book, published in 1895, on Certain Phenomena belonging to the Close of the Last Geological Period and on their Bearing upon the Tradition of the Flood, Professor Prestwich presented various phenomena which had come under his observation during long years of geological research throughout Europe and the coasts of the Mediterranean as "only explicable upon the hypothesis of a widespread and short submergence of continental dimensions, followed by early re-elevation; and this hypothesis," he added, "satisfies all the important conditions of the problem."

It will be observed that Professor Prestwich occupied a kind of independent position as a geologist, identified especially with no school, but forming substantially a school by himself. His publications, therefore, often embodied views different from the conclusions which his fellow-geologists had reached; or, to paraphrase an expression of his own, while they were all generally of one opinion as to the main facts of geology, in respect to the explanation of many of those facts they held very divergent opinions. This fact gave name and character to his last book—Collected Papers on Some Controverted Questions of Geology—which was published in 1875. It contained six essays, the first of which was devoted to the clear definition of the author's attitude with respect to the doctrine of uniformity, and the others were in criticism of the astronomical theory of Glacial epochs; the character, age, and make of the flint implements of the chalk plateau of Kent; the agency of water in volcanic eruptions; the thickness and mobility of the earth's crust; and underground temperatures. While these articles were all controversial, the book, as Professor Judd well said in reviewing it, "might fairly be cited as an example of the spirit in which scientific discussions ought to be carried out. No geologist who takes up this work but will find cherished ideas reasoned against or pet notions boldly assailed. But from beginning to end of the volume he will find that no word has been written which is calculated to give pain to the most sensitive opponent." In a similar spirit he exhorted the International Geological Congress in 1888: "Let us try to avoid that error of congresses—of arrogating an infallibility which is little in accord with the progress of science."

Nature, reviewing Professor Prestwich's book on geology in 1886, characterized him as the acknowledged master of British geology, of whom it might be safely affirmed that no living geologist had contributed in a greater degree to the advance of science by his important original researches.

Sir Joseph Lister, speaking in the Royal Society of his death, said that in him "we have lost about the last link that remained which connected geologists of the present day with the founders of the science in the first half of the century. To him we are indebted not only for the first comprehensive classification of the Tertiary beds of this country, to which he assigned the names by which they will henceforth be universally known, but also for their connection with the strata of the Paris basin. To him also is due the credit of having been the first to establish the authenticity of the remains of human workmanship found in the drift deposits of the valley of the Somme, and of thus having laid secure foundations on which arguments as to the extreme antiquity of man upon the earth may be based. In France his name is known and respected as much as in England, and it would be hard to say how much of the advance in geological knowledge during the last sixty years was not due to his unremitted labors, which extended over the whole of that period."

Professor Prestwich retired from the professorship at Oxford in 1888, and spent the rest of his life at his country home in Shoreham, working till almost his last day with undiminished activity. The list of his papers in the catalogue of the Royal Society includes seventy-seven titles, to say nothing of his contributions to other societies and journals. He was elected a fellow of the Royal Society in 1853; was appointed its vice-president in 1870; was president of the Geological Society in 1870; obtained the Wollaston medal of the Geological Society in 1849, and the Royal medal of the Royal Society in 1865; was president of the International Geological Congress in 1888; and was correspondent of the Institute of France, and foreign member of the Accademia dei Lyncei, Rome, the Imperial Geological Institute of Vienna, the Royal Academy of Brussels, the American Philosophical Society, and other learned bodies.

THE London Spectator recently had a story of a dog that could understand a telephonic message, and now has another of a little fox terrier which, when the family are from home, goes to stay with one of the workmen, three miles away. When the people return, they send word to the mill directing that "Donovan" be told of it. He invariably arrives in the afternoon. He is quite happy and contented at the workman's till he is told of the return of his master and mistress, but after that nothing will keep him from the house.

Editor's Table.

THE SCIENTIFIC ADVANCE.

AS the nineteenth century draws to its close there is no slackening in that onward march of scientific discovery and invention which has been its chief characteristic. Far from it, discovery and invention seem to be proceeding with ever-increasing rapidity; it is as if a fountain had been opened which, far from showing signs of exhaustion with lapse of time, gained in volume and force from year to year. Whether a pause will ever come is a question which many would be disposed to answer in the negative. It seems impossible that Nature, now that we have discovered the true method of interrogating her, should not go on revealing herself to us with greater and greater fullness. Without speculating, however, too deeply on the future, we may affirm that at present the scientific movement is at its maximum of vigor and productiveness.

It is astonishing to look back and see the strides that have been made in eighty or ninety years. In the beginning of the century there were stationary steam engines, and a few crude attempts were being made in the direction of steam navigation; but as yet the locomotive was a thing unthought of. To-day marine navigation has taken the form we see in the giant vessels that ply between this country and Europe and the first-class battle ships of the world's great navies, with their triple-expansion engines, their wonderfully perfected boilers, their twin screws, and their infinitely multiplied appliances for safety and efficiency.

At the beginning of the century electricity was a curious study, giving only slight promise of any useful practical applications. It had not advanced beyond the frictional machine, the Leyden jar, and the voltaic pile. The telegraph was as yet undreamed of, and the telephone and the dynamo utterly unimaginable developments. Had any one dared to conceive that signals could be made to pass in a second of time between Europe and America he would have been considered a fit candidate for Bedlam; and certainly not less insane would have been considered the notion that a human voice could by any device make itself distinctly audible at a distance of five hundred or even a thousand miles. To-day these things are commonplaces, and men are beginning to grudge the trouble of putting up wires for the conveyance of the electric current, great authorities in the scientific world having told them that theoretically it ought to be possible to do without such crude appliances. What was a curious toy in the beginning of the century is the jack-of-all-work at its close, or, in other words, the most widely available form of force in the modern world. What steam can not do, owing to the difficulty, on the one hand, of generating it locally, and, on the other, of conveying it to any great distance, electricity, which is capable of infinite subdivision and of distribution from a relatively distant center, stands ready to undertake.

We have only to look around us to see the innumerable wonders that science in its practical applications has wrought, and to be impressed by the beneficence of its operations. The electric light in our streets and the familiar trolley car constitute ad-

ditions to human well-being and enjoyment the value of which it would be difficult to estimate, while the telephone has almost revolutionized the industrial and commercial life of cities and towns. Electro-chemistry, again, and photography are two arts the influence of which is at once widespread and penetrating. The former dissociates the elements, isolating those we wish to isolate and leading others to form new and desirable combinations. It has produced what is virtually a new article of commerce in the metal aluminium, previously a rare and expensive product, and in a thousand ways has transformed or modified industrial processes. What photography is to the present age it would take a considerable treatise to set forth. The bookmaker, the traveler, the astronomer, the physician, the analyist, the architect, the biologist, the police agent, the engineer, the microscopist, the military man, the artist, and the representatives of a hundred other crafts and professions would all have to contribute to the tale. By photography we can record successive moments in the impact of a cannon ball and analyze the life history of a lightning flash; we pierce the abysmal depths of space and catch the faintly trembling rays of bodies that no telescope has the power to reveal.

With the general advance of science the physician's art has gained a wonderful enlargement of its resources. The mighty hunter of to-day is not he who bags big game in the African forest or the Indian jungle, but he who, following in the steps of Pasteur and Koch, tracks the pathogenic microbe to its lair and studies to render it innocuous. When anything nowadays goes wrong with the physical organism, the man of scientific mind is disposed to exclaim—parodying a celebrated saying—"Cherchez le microbe!" Already a very considerable knowledge and mastery have been gained of these extraordinary agents, so utterly unknown to the science of the past; and there is no reason to doubt that great conquests are yet to be won in this particular line of research. But other lines of investigation only less important in their bearing on the preservation of life and health have been opened up within the past generation. Of these scarcely any is more interesting than that which has led to the discovery of the "internal secretion" carried on by such organs as the pancreas, the thyroid gland, and the suprarenal capsules. "No one can suppose," said Professor Foster, in his recent address before the British Association, "that this feature of internal secretion is confined to the bodies mentioned; it needs no spirit of prophecy to foretell that the coming years will add to physiological science a large and long chapter, the first verses of which belong to the dozen years that have passed away."

If we pass over to the region of psychology, we find that there, too, a notable advance has been made both in methods and in results. Mind is being treated scientifically as something correlated in the most intimate manner with the body, and for all practical purposes a function of a certain kind of organized matter. The observations which have been made from this point of view are undoubtedly of the highest importance in the work of education, and intelligent teachers are daily making use of them to a greater or less extent in the practice of their profession. There is a vast amount of knowledge in the world to-day in regard to the laws governing the development of ideas and the acquisition of knowledge, and as to the specific differences between the child

mind and the adult mind, which did not exist when the century was young, and which would never have existed had not a better method—the outcome of physical investigations—been adopted in the study of mind. To this result the science of anthropology has contributed in no mean degree. To-day we study man not as an abstraction, not as a creature dogmatically proclaimed to be only "a little lower than the angels," but as he has actually manifested himself historically, and is now manifesting himself, in the sum of his habits, aptitudes, passions, customs, superstitions, imaginations, and achievements. We are at last taking to heart the advice of the ancient oracle, "Know thyself!" We see our true selves mirrored in the life of the race to which we belong.

In view of the vast accumulations of knowledge by which our age has been enriched, and of all that has been done within the last few generations for the betterment of human life, it might seem idle and paradoxical to doubt that the future is full of the brightest promise for our race. We have no disposition to join the prophets of evil of whom the present day possesses not a few. It is well, however, to remember that there is a double aspect to almost every advance in knowledge and in the perfection of the arts. Every gain tends to the disuse of some portion of human faculty, and unless it calls other portions into a more than compensating activity there is really no resulting benefit, so far as the development of the individual is concerned, and there may even be a loss. It would take us too far to illustrate this in any detail; but it is quite evident that many useful inventions, such as improved means of transit, the telephone, etc., while they quicken the pace of life, do not prompt either to physical or to intellectual exertion, and that the vast provision made to-day for the entertainment and amusement of the multitude has little educative value and may even tend to the injury of the reflective powers. Amid the ever-increasing multiplicity of luxuries and novelties of every kind that are spread before the people to tempt the outer senses, the needs of the inner man are apt to be thrust aside and forgotten. In the illustrated books that are prepared for children so much is exhibited to the eye that nothing is left to the imagination. It sometimes seems almost possible that the modern world might be choked by its own riches, and human faculty dwindle away amid the million inventions that have been introduced to render its exercise unnecessary.

Further than this there is a tendency, which we think is already beginning to be well defined, to effect a radical differentiation between those who are concerned in carrying on the work of the world as thinkers and inventors and those who are only concerned in using the improved appliances placed in their hands. Some of our readers will remember the horribly grim development suggested in Mr. H. G. Wells's fantastical romance, The Time Machine—a degraded humanity inhabiting an externally perfected world. Without taking seriously so horrible a possibility, what we seem to see is that the times call for very special efforts to spread the knowledge and culture which are the product of the age, so that the intellectual life of the whole mass of society may be quickened. The leaven of thought and knowledge should be so applied as to work everywhere; in order that, while there may still be leaders of thought moving in regions inaccessible to the multitude, there may at least be no considerable sections of society

sodden in ignorance, and living lives of children or savages amid the light of a scientific age.

THE USES OF EDUCATION.

WE fear that, with all the alleged improvements that are being introduced into the methods of education, the true end of education is being more and more lost sight of. The idea that education is essentially a preparation for money-making is, it seems to us, gradually taking complete possession of the popular consciousness. It is needless to say that this was not the ancient ideal. To-day we look upon arithmetic as indispensable for the earning of a living. Plato, as Oscar Browning remarks in his little book on Educational Theories, considered it "as the best spur to a sleepy and uninstructed spirit." Admitting that the modern view must be recognized, why should not the more elevated ancient view be recognized as well? But what child is made aware to-day that in studying arithmetic he is doing more than acquiring an instrument by which afterward money may be made? There is just as much need to rouse sleepy spirits now as there ever was; and there are more sleepy spirits than ever to be roused. We fear the arithmetic of the public schools is not doing as much to rouse them as might be desired, and the reason may partly be that the higher intellectual and moral uses of the study are not kept sufficiently in view.

In the Greek scheme of education "reading" (we quote from Mr. Browning) "was taught with the greatest pains; the utmost care was taken with the intonation of the voice and the articulation of the throat." If anything of the kind were proposed to-day, objection would at once be raised that such training of the ear and vocal organs might be very useful, and pecuniarily profitable, to a youth who was going to be a professional elocutionist, but that for others it would be a waste of time. So with the study of modern languages: their utility is recognized in so far as they may be required for business purposes, and perhaps for actual use in foreign travel. That they may become a source of refined intellectual pleasure by extending one's survey of the development and differentiation of thought is, to say the least, not an everyday conception. Geography is, of course, regarded as an essentially commercial study, not as one that ought to liberalize the mind by removing ignorance in regard to foreign countries, and creating a sense of the kinship of the whole human race.

Even in our higher seats of learning the ultra-practical or technical view of the use of education more or less prevails. In an excellent article by Mr. Irving Babbit, in a recent number of the Atlantic Monthly, we read that "one of the first things that struck M. Brunetière on coming into contact with our university life was the predominance of purely analytical scholarship—a predominance which he attributes to an excessive imitation of German models. He even agreed with the opinion expressed by one of the Harvard professors, that several of our great universities are in danger of degenerating into mere technical schools as a result of losing hold on the old humanistic ideal."

The humanistic ideal is founded on the old truth which, in a manner, we still profess to believe, that "the life is more than meat, and the body than raiment." According to that ideal, the business of education is to enable a human being to enter on full possession of all his faculties, in order that, so far as possible, he

may be perfect as a human being. A man or woman who has been truly educated according to this ideal is not dependent for his or her enjoyment of life on coarse pleasures or childish excitements. There are sources of happiness in the awakened intellectual and moral powers and the well-trained physical organism that are not exhausted even with advancing years. The question which educationists have to consider is whether it is not possible, without sacrificing in any degree whatever the just claims of practical life, still to uphold and make manifest that higher conception of education which existed in past times, and which is still cherished wherever liberal views of life prevail. If arithmetic, geography, grammar, the sciences, and languages are consciously used with a view to intellectual and moral results, that surely will not interfere with a subsequent "practical" use of the knowledge gained by the pursuit of those studies. If we are not mistaken, we see indications of a growing feeling that education in the higher sense to which we refer is not democratic. That is a point on which we are not prepared to pronounce an opinion; but certainly the education we should desire for any one in whom we felt an interest would not be one which left his whole higher nature out of the account.

PARENTAL NEGLECT AS A CAUSE OF HOODLUMISM.

It may be doubted if ever in the history of this country complaints of lawlessness, particularly of that kind known as hoodlumism, were so bitter and so universal. The evil is not confined to the South, where the ravages of the civil war left a deep mark of demoralization, nor to the far West, where the rudeness of frontier life is no stimulant to virtue. Even in the East, in New England, the home of Puritan order and virtue suffers from it. So serious and widespread has it become in towns still inhabited by the descendants of the stern men and women that fled from the vice and intolerance of the civil and ecclesiastical rulers of England that Prof. Charles Eliot Norton, at the dinner given to fellow-professors at Ashfield, Mass., a few weeks ago, was moved to sound the alarm, taking as his text the shocking murder of a woman at Shelburne Falls by a village ruffian of New England birth.

The address, startling but not sensational, has evoked very general discussion. It has stimulated the production of theories to account for this flood of lawlessness. One is the absence of proper police surveillance to restrain the disorderly instincts of the ruffian. Another is the absence of the civic virtue that compels people to take part in public affairs, and to see to it that life and property are protected. While both are doubtless worthy of consideration, neither of them goes to the root of the matter. We are still in the dark as to the reason of the absence of civic virtue and the presence of criminal instincts. Why, after all our elaborate legislative efforts to make people walk in the straight and narrow path, and to provide them with all the educational advantages that money can buy, is it true, in the bitter words of Alphonse Karr, that "*plus ça change, plus c'est la même chose*"? In other words, why have all our efforts to promote civilization resulted only in the revival of barbarism?

We believe that the chief of the Massachusetts police has hit upon one of the most potent causes of this deplorable state of affairs. "The root of the trouble," he said, when asked his opinion of Professor Norton's address, "lies in the fact that so many parents are lax in bringing up

their children. . . . In proof of this, look at the streets of our cities after nightfall, swarming with rude, unmannerly boys taking their first lessons in hoodlumism. Parents fail to realize their responsibility toward their children." When this is the case, what more can we expect than the prevalence of lawlessness in town as well as city, in the East as well as the West, in the North as well as the South? Children that have not been subjected to the firm but gentle discipline of the home, that have not been taught by their parents the habits of order, decency, and virtue, are not likely to grow up with a sense of their duty to themselves or to their fellows. They are almost certain to grow up as loafers, or corruptionists, or as citizens indifferent to the demoralization around them. It is still as true as it ever was in the old copy book that as the twig is bent so is the tree inclined.

But why are parents lax in bringing up their children? Why do they fail to realize their responsibility toward their offspring? Nothing is more important in the world than parenthood; it is the basis of society and civilization. Nothing is better fitted to give pleasure. We believe that some German pessimist has condemned it on the ground that as long as it prevails the desire to live will never be extinguished. When men and women lose their interest in the world itself, they cling to it because of their interest in their children; and when their children have grown up, it is still maintained by their interest in their grandchildren, ever hoping to see realized in the lives of the new generation the dreams of happiness and fame that were never realized in their own. However cynical and depressing this may be, it has unquestionably much of truth. The survival of those children whose parents took the best care of them has given birth to a set of powerful feelings that can be gratified only through parenthood. These feelings, sacred above all others, respond to efforts to protect the child from harm, to develop its intellect, to cultivate its manners, to intensify its affections—in a word, to make it a good man or woman, capable and high-minded.

Yet how recklessly and amazingly have parents strayed from the path that will lead them to the greatest happiness vouchsafed to any human being! How ceaseless have been the efforts to convince them that there is another way for them to attain this bliss and at the same time hasten the advent of the millennium! So successful have these efforts been that it is now expected that the public schools shall do all the work that Nature herself designed for more fit and tender hands. Only last summer the Superintendent of Public Education of the State of New York set forth very elaborately the new theory of parenthood, or, rather, revived the old Greek theory with slight modifications. "The State," he said, "has a right to demand from the schools that children be trained, first of all, to a thorough mastery of the studies in the elementary course. . . . But with these studies," he continued, demanding the impossible, "should be taught courtesy of manner, politeness of speech, refinement of thought, and genuine culture of life. The State has the right to expect also that pupils from the beginning of their course be imbued with the spirit of honesty, with the love of truth and purity, with integrity of thought and action. . . . While it is never the province of the State to teach religious truth after the distinctive tenets of any form of belief, it is emphatically the duty of the State to see that children are taught the highest and purest morality."

Is this not an assumption by the State of most, if not all, the duties that belong to parents? Who better than they can teach "courtesy of manner, politeness of speech, refinement of thought, and genuine culture of life"? Who better than they can inspire them "with the spirit of honesty, with the love of truth and purity, with integrity of thought and action"? Who better than they can see to it that "children are taught the highest and purest morality"? The association of parents with a child is constant and extends over many years; that of any public-school teacher, intermittent and very brief. There are the ties of an affection that bind them to it and impel it to obey them that do not exist, except feebly, between it and the teacher. These ties are of the utmost importance. Nothing should ever be said or done to weaken them. On the contrary, everything should be said and done to strengthen them for use in the guidance of the footsteps during impressionable years. It was by the pursuit of this course that Alphonse Daudet was enabled to enjoy the complete and loving confidence of his children as long as they remained under the parental roof, and to shape their lives in a way that, when they passed from his wise and gentle direction, there was no tendency to revert to barbarism, such as we see to-day everywhere in the United States.

If an end is to be put to this evil, the preaching and practice of the vicious doctrines that pervade the address of Superintendent Skinner must cease. When any work for the betterment of the moral and physical welfare of children is to be undertaken, it must not be thrown upon the State, which has come to consist of nothing more than the politicians, whose violation of all the virtues he enumerates with such eloquence is the theme of countless philippics in pulpit, press, and conversation; it must be assumed by parents, who alone have the power to inculcate those virtues with any degree of success. While we do not believe with Professor Norton that there should be a restoration of Puritan discipline with the theology left out, we do believe that there must be a restoration of Puritan responsibility toward children, tempered with love and unfailing patience. It will lead parents to assume a vastly larger share in the work of education than they now do, thus strengthening the ties of affection so potent for moral control, and making it impossible for children to desire or parents to allow them to go on the streets to take "their first lessons in hoodlumism."

Scientific Literature.

SPECIAL BOOKS.

THE SCIENTIFIC SPIRIT IN KIPLING'S WORK.

THE collected edition of Mr. Kipling's prose and verse* published by the Messrs. Scribner presents the successful execution of a singularly felicitous idea. The Soldiers Three stories, which first made known the appearance of a new genius, were scattered in various legitimate and pirated editions like the tales of social and of native life in India. Even the Jungle Books

* The Works of Rudyard Kipling. Outward Bound Edition. Large 12mo. Uncut, gilt top. Illustrated by Lockwood Kipling. Volumes I to X. New York: Charles Scribner's Sons.

lacked the last tale—perhaps not the last—for In the Rukh appeared in Many Inventions, published by D. Appleton and Company in 1893. For the first time, therefore, we now have a properly classified exhibition of the wealth which Mr. Kipling has added to imaginative literature. The titles of the volumes under the present systematic arrangement are Plain Tales from the Hills, Soldiers Three and Military Tales (two volumes), In Black and White, The Phantom Rickshaw, Under the Deodars and Other Stories, The Jungle Books, The Light that Failed, and The Naulakha. The illustrations have been photographed from reliefs modeled in clay by Mr. Kipling's father. The light paper, handsome type, with its firm, clear impression, the generous margins, and dignified binding are reasons for congratulations to publisher and reader alike.

If this were the place for purely literary comment upon Mr. Kipling's splendid gifts much might be written of the tremendous power of his best expression, the resonance of his song, his quick insight into motives, and his control of a gamut which might be deemed to run from Hood to Poe, since his imagination, power of sympathy, and his quick humor thrill us, or move us to laughter, at his will. But all this the reading world has recognized. Very little, however, has been said of Mr. Kipling's application, possibly more or less unconscious, of scientific principles in his work. It is quite unnecessary to explain that Mr. Kipling is not an ethnologist because he differentiates the Hindu, Sikh, or Afghan so consistently, or because in all his work he expresses more forcibly than any other writer the characteristics which have made England a great imperial power. He is not an alienist because of The Madness of Private Ortheris, or The Man who Was, or In the Matter of a Private, or The Phantom Rickshaw, or The Disturber of Traffic, or At the End of the Passage, and yet a professional alienist might well accept his diagnosis of certain phases of mental aberration, his description of the effects of certain hallucinations and illusions, and his description of severe mental shock and aphasia in The Man who would be King, and elsewhere. He is not a physiologist, but his exactness in indicating the physiological effects of strong emotions—witness Mulvaney in battle—is another indication of the quality of his analytic observation. To cite a very different instance, in a preface to Wee Willie Winkle Mr. Kipling has illustrated his attitude toward children in saying: "If a mere man keeps very quiet and humbles himself properly, and refrains from talking down to his superiors, the children will sometimes be good to him, and let him see what they think about the world." This, as Mr. Gosse has said, suggests the collector of exact data, the naturalist lying quietly in the grass and noting the habits of birds and animals.

The wonderful Jungle Stories have added a new character to fiction in Mowgli, yet if we judge the other characters by our special standard Mr. Kipling's power of getting at the roots of things—of reasoning to causes—is perhaps less apparent in these stories for a reason not far to seek. Certain familiar motives shown in mating and in jealousy, in the father's place as provider and in the mother's care for her young, in instincts of self-defense and revenge, and in quasi-tribal organization and leadership would naturally lend themselves to a writer's purposes. But while certain truthful characteristics are retained, the developed personification of Mr. Kipling's animal heroes takes them almost as much out of the field of exact observation as the animals of our own Indian mythology. The reason of

this is found in the very simple justification offered by the claims of art. Dr. Groos's Play of Animals, shortly to be published in English, is a very valuable example of the scientific attitude. That Mr. Kipling's literary treatment has been untrammeled is a cause for congratulations, unless we are to beg the question at the outset by relegating imagination to fairy tales pure and simple. Now, Mr. Kipling does not deal in fairy tales, but primarily with motives which are practical. When Shelley enshrined the skylark in literature he did not clip the wings of his song with an explanation that the skylark sometimes destroys crops in Germany. This fact would have been noted by Mr. Kipling, and in one way or another his imagination would have found a way of suggesting it in a purely literary form. This is an extreme case, but it illustrates fairly enough a mental curiosity, alertness, and keenness of perception which would have made a mark in laboratory work, let us say, if Mr. Kipling had been a student of science. The suggestion gains piquancy from the constant presence in Mr. Kipling's work of a quality diametrically opposed to this—the martial spirit, which is quite the reverse of the scientific. Mr. Kipling's earlier years of association with the British army in India have left an impress which will remain. In spite of the nobler motive of the magnificent Recessional, the ring of the sword is heard throughout the larger portion of his verse and prose, a note due to his intense vitality and personal force, as well as to the accentuated patriotism of the poet laureate of Greater Britain.

Patriotism, however, which we are assured is unscientific and merely a phase of selfishness, has nothing to do necessarily with another phase of Mr. Kipling's literary performance—his literary conquest of the new realm of applied science. From him we have learned that the locomotive engineer may be a more romantic figure than the mailed knight, and that the passing away of white sails has lessened in no degree the poetry of the sea. The central motive of our time is the application of science to industry, but it was left for Kipling to sing the song of steam in McAndrew's Hymn. One grows chary of the use of that time-honored phrase "a new note." There have been so many "new notes" which have died away into a silence never broken afterward. But if Mr. Kipling should write no more, he has already proclaimed the romance of machinery, the heroism of "earth's chosen men of strength," the significance of the deep-sea cables, "blind, white sea snakes," and he has expressed the appeal to the poet's imagination made by phases of invention, commerce, and manufacture, which have had hardly a superficial recognition heretofore. There are critics who quarrel with Mr. Kipling's liberal use of the nomenclature of marine engines and locomotives, but that is not a quarrel to be insisted upon. Possibly, like a student in the first flush of enthusiasm, he is unconsciously zealous to show that he does not "miscall technicalities," but "coupler flanges" and "spindle guides" by the score will not prevent such work from reducing the number of "damned ijjits" who whimper that "steam spoils romance at sea." Quite aside from purely literary quality, with which we are not primarily concerned in this place, Mr. Kipling's power of concentration, his application as a student, and his ability to master practical details are exhibited to a very striking degree in McAndrew's Hymn, in The Ship that Found Herself, in his long story Captains Courageous, and in his story No. 007, which appeared lately in Scribner's Magazine. We do not think that a story like the last furnishes the human interest

or the enjoyment found in the best of his Indian tales. The personification of the familiar locomotive or, for that matter, the horses in a Vermont pasture, inevitably comes, if not as an anachronism, at least as a wound to that desire for the possible which unconsciously guides adult readers of pure fiction. Nevertheless, all this treatment of applied science is, as we have said, the opening of a new territory, in which we believe Mr. Kipling will find many lasting additions to English song and also to English fiction. While a few exceptions have been taken to the correctness of his technical phrases—for example, by Mr. Cy Warman in his verses on No. 007—Mr. Kipling's accuracy is phenomenal. Noting this in the London Academy a year ago, a sailor remarked: "The secret of his success is that he always goes straight to the fountain head for his information. . . . His mind can best be compared in acquisitiveness to a sleepless octopus, always gathering in something with each of its tentacles." So far as his work in fiction is concerned, we think the human interest of the lives on an overinsured, unseaworthy tramp steamer will make a more direct appeal than the conversation of cylinders and piston rods, notwithstanding the usual moral. Like Cromwell's soldiers, Mr. Kipling believes in the moral law, the wrath of God, a stout arm, and a sharp sword. Like a Roundhead also, he feels at times a stern sense of judicial responsibility toward the quick and the dead, especially if they are Americans.

This brings us to one last point, barely to be touched upon, which is that Mr. Kipling's remarkable power of perception and analysis is not accompanied by a corresponding power of synthesis. This is quite at variance with the common judgment, but it may be illustrated by comparisons of sketches of individuals with the romantic passion of his devotion to the Empire, or, again, by a comparison of single types with the curious image which Mr. Kipling has evolved in The American—a poem which should have had as its logical complement some verses on the Jameson raid, the British war ships at Crete, and the Armenian atrocities. But this is a small matter, so far as we are concerned, and youthful tendencies to sweeping generalizations are commonly too unimportant to call for any other remedy than time. Mr. Kipling has so many qualities essential to a scientist that one is the more disposed to deprecate occasional broad assumptions and the influence of acid prejudices; but any limitation is suggested with reluctance when one writes of the young genius who within ten years has become the foremost active figure in the English literature of this day, the most sonorous singer of verses, and the most impressive story teller. We have yet to mark his arrival as a novelist. Meantime the perfectly appointed edition of the Messrs. Scribner is a necessity for those who would have their libraries include some of the best gifts which English letters have offered to the world—gifts from a young man of thirty-two, with his richest years yet before him.

In *The Present Evolution of Man*,* Mr. *Reid* discusses the question whether the struggle for existence has ceased with man. Dr. Moxon, whose declaration is quoted among those of other authors to furnish a text for the essay, affirms that it has, and that the conflict is now one against *mere* existence. The latter aspect of the question is not touched in the book. Dr. Moxon's attitude is treated as characteristic of that of the majority of

* The Present Evolution of Man. By G. Archdall Reid. London: Chapman & Hall. Pp. 370.

the general public, and also of the majority of medical men, who, "while observing the effects of disease on man the individual, have signally failed to observe its effects on man the species." While he accepts evolution in its widest and most absolute sense as a certainty, the author differs from the usual views, in that in his opinion acknowledged authorities have not recognized or have not laid sufficient stress on certain processes of evolution which appear to him of the greatest importance. The book is intended to lead up to the presentation of these processes, and is divisible into two parts, in the first of which the problem of evolution in general is briefly considered, with an attempt to penetrate somewhat deeper in certain directions than has hitherto been done, and in the second part the conclusions arrived at are applied to the problem of man's present evolution, with an endeavor to show that this evolution is proceeding in a direction hitherto altogether unexpected. The processes of evolution are supposed to be singly, inappreciably minute, and all as still going on—even spontaneous generation, which we do not discover, because the really earliest forms of life are beyond all devisable means of observation. The inheritance of acquired qualities as a factor of evolution is rejected, and the process is held solely dependent on the survival of the fittest. Yet the variations acquired by every normal individual have a magnitude and importance far beyond that which is commonly attributed to them by biologists. The present evolution of man, while development in bodies and brains is an element in it, is mainly an evolution against disease. The stage of evolution reached by European races is the result of a long process of selection against certain classes of diseases to which they have become comparatively proof. The natives of other regions into which European civilization is extending itself have this immunity yet to acquire. Hence the deadly influence of our civilization upon them when they are subjected to it. Other agencies which are the causes of the elimination of the unfit are the narcotics. The influence of these two classes of factors, and the nature and extent of the modifications affected by them in physical and mental conditions, are the subjects of the second part of the book.

GENERAL NOTICES.

To the American Lectures on the History of Religions, given under the direction of an association representing a number of co-operating institutions and local boards, Dr. *Daniel G. Brinton* has contributed a course on *Religions of Primitive Peoples*,* which were delivered during the winter of 1896–'97 at Boston, Brooklyn, Ithaca, New Haven, New York, Philadelphia, and Providence. By primitive peoples are meant those of the earliest stage of culture of which trusty information exists, while religion, hardly susceptible of a limited definition, is regarded as in some form or other universal in the human race. The study, of which these lectures present the fruits, undertaken without bias or partisanship, but looking upon all religions alike "as more or less enlightened expressions of mental traits common to all mankind in every known age," is pursued by the historic, the comparative, and the psychologic methods. Laying down his postulates in the first lecture, Dr. Brinton discusses in the five succeeding lectures The Origin and Contents of Primitive Religions, Primitive Religious Expression—in the Word, in the Object, and in the Rite—and The Lines of Development in Primitive Religions. All the religions are regarded as unconsciously directing and impelling the mind toward the abstract stage, when the idea

* Religions of Primitive Peoples. By Daniel G. Brinton. New York: G. P. Putnam's Sons. Pp. 264. Price, $1.50.

stands by itself as the recognized guide of conscious effort; when infinity or perfection is no longer conceived in relation to a being or personality, but is still the loftiest motive and the deepest source of spiritual joy—a goal that may be still far away but is ultimately to be reached.

When we stroll along the road we see many things in plant and animal life to awaken curiosity and interest; but as we are generally intent upon other matters and do not usually know precisely what they are and how they are related to one another, we pass them with little notice and straightway forget about them. Mr. *F. Schuyler Mathews* has undertaken, in his *Familiar Features of the Roadside*,* to awaken a more genuine and lasting interest in these objects and to furnish information that will help us to identify and distinguish them, and to become, as it were, more personally acquainted with them. "It might be possible," he says, "to find a wider field for the study of Nature than the highway, but in many respects certainly not a better one, for if we keep on traveling we will have eventually seen and heard about everything that is worth seeing and hearing in the wide world." This may be strongly expressed, but there is certainly vastly more than we suspect to be found by sharp eyes and keenly tuned ears on the mountain tops and the seashore, and in the bogs, forests, meadows, pastures, glens, hills, lakes, rivers, and brooks by which the road will lead us if we follow it far enough. The author describes such of these things as he has observed and as came to his mind, and arranges and classifies them according to the seasons and their associations. Thus he tells of the flowers we may find early and late and the families to which they belong, the singers of the meadow and woodland and with musical and unmusical voices, not letting the birds monopolize attention at the expense of the frogs and squirrels; and of the colors on mountain, meadow, and woodland, and of the colors of autumn. In the first chapter, telling of a spring walk, all the flowers we are likely to meet are described, and more kinds of singing amphibians are differentiated than one without special information would suppose existed. The illustrations are fitting and excellent, and the bird notes and other intonations are written in music.

The main purpose of this volume * is to present the results of recent archæological investigations in Tennessee, and more especially the district in which the so-called mound builders' remains are found. The original volume was published several years ago, and its complete sale, combined with the recent interesting and important discoveries, have led the author to the preparation of this revised and somewhat extended edition. The subject is presented in a series of historical and ethnological studies, the material being found principally in the cists or box-shaped graves built of stone slabs which have been so extensively exhumed of recent years in Tennessee. In accordance with a common custom among savages at a certain stage of development, these prehistoric people placed vessels containing provisions and various utensils in the graves for the use of the deceased on his journey to the spirit land. The remains, thus sealed up and protected from the waste of time, are now exhumed in a very perfect state of preservation. They tell the story of ancient domestic life in the Cumberland and Tennessee Valleys with remarkable exactness, and hence are of great ethnologic interest. Mr. Thruston describes them with much detail. There are about three hundred and sixty fairly good illustrations.

When Mr. *Ward's* book † first appeared in 1883, you might probably have made the rounds of the colleges without ever hearing the word sociology, and if you did it was only some grammarian growling about the liberties which ignorance was forever taking with etymology. But now, on the contrary, the word and its congeners are almost as om-

* Familiar Features of the Roadside: The Flowers, Shrubs, Birds, and Insects. New York: D. Appleton and Company. Pp. 269. Price, $1.75.

* The Antiquities of Tennessee and the Adjacent States. By Gates P. Thruston. Cincinnati: The Robert Clarke Company. Pp. 369. Illustrated. Second edition.

† Dynamic Sociology, or Applied Social Science, as Based upon Statical Sociology and the Less Complex Sciences. By Lester F. Ward, A. M. In two volumes; second edition. New York: D. Appleton and Company. Pp. 706 and 690. Price, $5.

nipresent as the barrel organ. At the forefront in bringing about this popularization of sociology has been Mr. Ward's book itself. It is now an important and largely patronized department in nearly every college and university in the country, has numerous periodicals devoted entirely to its treatment, and has even made a place for itself in the daily papers. The subject is of interest to every one, and is of such a nature that a little careful study amply repays the student both in new knowledge and as mental training. This increase of general interest in sociology has made a new edition of Mr. Ward's book necessary. As the work was given a long and appreciative review in these pages in June, 1883, we shall simply refer readers to that issue for further information.

*The Student's Manual of Physics** has been adapted by the author, Mr. *Leroy C. Cooley*, for use in the combined method of teaching by oral instruction, text-book study, and laboratory work. It contains much less material than other elementary text-books for purely illustrative work, and much more of that which is necessary for systematic and successful quantitative study. Throughout the book a laboratory course accompanies the text, the experiments being described at the close of the numbered sections and set in different type. By cross references and a systematic notation attention is directed to the facts and principles that have been already studied and are involved in the study of the subject in hand. The author insists as an important feature on the pains he has taken to preserve continuity in the discussions and a smooth flow in the transitions from one subject to another, also on his attempt to impart clear-cut conceptions of physical quantities and avoid ambiguities. The explanations are clear and lucid, and the manner of the book is modern.

The *Natural Elementary Geography* of Mr. *Jacques W. Redway*† represents the latest methods in the study and teaching of the science, and is composed in accordance with the recommendations of the Committee of Fifteen. The central idea of the treatment pursued in it is man, his history, customs, industries, and geographical relations; and the different countries are described according as they relate to man. In the beginning the pupil is started from home and is taken eastward to the Atlantic and then westward to the Pacific, while the characteristic features of the country he passes over and the settlements are insisted upon and made plain. He is then taken across the ocean and to other countries, and they are described nearly in the order of the closeness of their relations with us. For the United States the old arbitrary divisions based on location are subordinated to divisions according to elevation, climate, and industries. In Europe the divisions are according to racial lines. The maps are physical and political, so adjusted as to scale as to give correct ideas of the comparative areas of countries. The illustrations are all intended to instruct and are excellent.

This little work,* one of a series entitled Home-Reading Books, is rather difficult to place. It is in the first place as fascinating as a fairy tale, and in the second so instructive as to be repellent to the mind of the average youth. It is an attempt to interest the child in a class of life which abounds in every pond and stream—namely, the protozoa. Each of these apparently characterless little masses of protoplasm, with far less intelligence than the average clam, assumes under the treatment of Miss Bayliss a personality almost as distinct as that of our human neighbors. In Chapter I, which is devoted to rhizopods, the leading member is the amœba, introduced as the "slowest thing on earth." The whiplashers are visited in the second chapter. Then come the ciliata, succeeded by an amusing chapter on protozoan philosophy. There are eleven chapters, the last of which, The Greatest Joke of All, might have been appropriately labeled As Others See Us, being an examination under the microscope of the human youth conducted by the

* Physics: The Student's Manual for the Study Room and Laboratory. By Leroy C. Cooley, Ph. D. American Book Company. Pp 448.

† Natural Elementary Geography. By Jacques W. Redway. American Book Company. Pp. 144. Price, 60 cents.

* In Brook and Bayou, or Life in Still Waters. By Clara Kern Bayliss. Illustrated. New York: D. Appleton and Company. Pp. 175. Price, 60 cents.

various creatures which the previous chapters have thus studied. The book is well printed and illustrated, and, while there are some lapses into technical phraseology, the text is in the main readily comprehensible by a child of ten or twelve.

A work by Dr. *C. Christiansen*, of Copenhagen, on the *Elements of Theoretical Physics*, has been translated by Prof. W. F. Magie, of Princeton (Macmillan, $3.25). Although with ill-judged modesty labeled "Elements," it is an advanced text-book presenting the mathematical side of the subject exclusively and using the calculus throughout. The translator deems it valuable because it presents the fundamental principles of theoretical physics, and develops them so far as to bring the reader in touch with much of the new work that is being done in the subject. While not in every respect exhaustive, he regards it as stimulating and informing, and as furnishing a view of the whole field that will facilitate the reader's progress in special parts of it. He says further that there has been a need of such a book in which the various branches of the subject are developed in connection with one another and in a consistent notation.

The lectures delivered at the Princeton sesquitennial celebration by Prof. *A. A. W. Hubrecht* on *The Descent of the Primates* have reached us in book form (Scribner's, $1). While the subject is a highly technical one, and the treatment is necessarily such as to place the argument beyond the reach of any one but a specialist, the investigation has so important a bearing on the evolutional origin of the human race that it has been deemed worthy of permanent form. The contention is, briefly, that the usual way of looking upon the three subdivisions—the duckbills, the marsupials, and the placental mammals—as a real and historical sequence is not in accordance with their true relationships. This is not, as the author says, a new idea, but was originated some years ago by Huxley. The author has derived his material chiefly from a study of the embryology of the tarsius, a curious and rare form hitherto ranked with the lemuroids.

The Mechanical Arts Simplified, by *D. B. Dixon* (Laird & Lee, Chicago), is one of those so-called handbooks of useful information. It seems to contain a great deal of accurate information, in the shape of tables and formulæ, for the mechanic and the mechanical engineer, but it is largely a compilation of unrelated and isolated facts which have little practical value for the average mechanic, and which are of slight value, at best, in such a book, because of the difficulty of finding them. For instance, on page 258 we have first a table giving the weights of thirteen metals, followed by some tables on flour and corn mills extending through page 259; page 260 discusses the miner's inch and the flow of water through vertical rectangular openings, and page 261 gives us, among other things, a table of mortality statistics based on American experience, the date when the first steamboat plied the Hudson, when the first sawmaker's anvil was brought to America, when kerosene was first used for lighting purposes, when the first lucifer match was made, and the date of the appearance of the first newspaper advertisement.

A list of *Reagents and Reactions known by the Names of their Authors*, based on the collection of *A. Schneider*, has been issued by the Pharmaceutical Review Publishing Company, of Milwaukee. It is of interest chiefly to pharmacists and analysts (price, 50 cents).

A little volume on *Les Insectes nuisibles*, by *A. Acloque*, that has recently come to us is devoted to giving the habits and mode of development of noxious insects, and the best known means of combating these creatures. The book contains sixty-seven cuts. (F. Alcan, Paris, paper, 60 centimes; cloth, 1 fr.)

In *English Local Government of To-day* (Vol. IX, No. 1, Columbia Studies in Economics) *M. R. Maltbie* gives us a careful economic discussion of the relations between central and local government. The purposes of the inquiry are thus set forth in the introduction: "First, to show the growth and historical development of the English system of central and administrative control; second, to outline its present legal and practical status; and, third, to ascertain the actual results obtained through it." The author arrives at the conclusion that local self-government, pure and simple, has been proved inefficient, and that it is possible to estab-

lish a system of central administrative control which does not destroy local autonomy, but which secures efficient administration while not encroaching upon those ideas and principles for which Anglican institutions have so long been prized.

Papers and notes on *The Genesis and Matrix of the Diamond* (Longmans, Green & Co.), by Prof. *H. C. Lewis*, is a technical account of the geological formation in which the Kimberley and adjacent diamonds occur. The basis of the work was two lectures, delivered before the British Association in 1886 and 1887. They have been deemed of enough importance to deserve permanency, and, under the editorship of Prof. T. G. Bonney, have been combined with some isolated notes on the occurrence of diamonds elsewhere into the present volume. There are thirty-five illustrations.

In *Sex Worship* (published by the author, *Clifford Howard*) we have an attempt to treat this rather difficult topic in a popular way. Up to this time, as the author says, the subject has been confined to a small class of scholars and investigators, whose works are difficult to obtain, both because of their rarity and costliness. The present volume has no value to the scholar because of its superficiality, and is, we think, little suited to general circulation because of its subject.

No. 6 of the Field Columbian Museum Zoölogical Series is a *List of Mammals from Somali Land*, obtained by the museum's East African expedition. There are about fifty pages of text and twenty-five full-page plates. The material has been arranged by the curator of the museum, D. G. Elliot. The expedition was a much-needed one, and because of the rapid disappearance of the large wild game in Africa and the information and specimens obtained will in a very few years be the only means of studying many of these animals.

PUBLICATIONS RECEIVED.

Agricultural Experiment Stations. Bulletins and Reports. Cornell University: Agricultural Extension Work: Sketch of its Origin and Progress. Pp. 12.—New Jersey: No. 124. Milk. Pp. 19.—North Dakota. Climate and Crop Service, August, 1897. Pp. 8.—Ohio: No. 81. The San José Scale in Ohio. Pp. 48.—United States Department of Agriculture: No. 58 Long Beans as a Forage Crop and as Food for Man. Pp. 24; Do., Division of Forestry, No. 16: Age of Trees and Time of Blazing determined by Annual Rings. Pp. 11; Recent Legislation on State Forestry Commission and Forest Reserves. Pp. 15; Do., Division of Entomology: No. 7. Revision of the Tachinidæ of America North of Mexico. Pp. 150.

American Academy of Political and Social Science. Roland P. Falkner, Editor. Monthly. September, 1897. Philadelphia. Pp. 164. $1.

American Association for the Advancement of Science. Resolutions adopted on the Greater Uniformity of Scientific and other Literature, with Remarks. Salem, Mass.: The Salem Press. Pp. 57.

American Climatological Association. Transactions for 1897. Philadelphia. Pp. 250.

Andrews, Gwendolen Foulke. The Living Substance, as such, and as Organism. Boston: Ginn & Company. Pp. 176. $1.50.

Austin, Oscar Phelps. Uncle Sam's Secrets. New York: D. Appleton and Company. Pp. 344. 75 cents.

Baldwin, J. Mark. Social and Ethical Interpretation in Mental Development. New York: The Macmillan Company. Pp. 574. $2.60.

Bryan, Anthony H., M.D. Philosophic Consideration of Electro-Planetary Phenomena. Pp. 16.

Bullock, C. J. Introduction to the Study of Economics. Silver, Burdett & Co. Pp. 511. $1.28.

Bureau of American Ethnology. W. J. Powell, Director. Sixteenth Annual Report. Pp. 326. Also the same from the Smithsonian Institution.

Conn, H. W. The Story of Germ Life. New York: D. Appleton and Company. Pp. 199. 40 cents.

Cornelius, Hans. Psychologie als Erfahrungswissenschaft (Psychology as an Experimental Science). Leipzig: B. G. Teubner. Pp. 445. 10 marks.

De Manacéine, Marie. Sleep: Its Physiology, Pathology, Hygiene, and Psychology. Imported by Charles Scribner's Sons. Pp. 341. $1.25.

Dowden, Edward. A History of French Literature. New York: D. Appleton and Company. Pp. 444.

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Franks, Fanny. The Kindergarten System: Its Origin and Development as seen in the Life of Friedrich Froebel. Syracuse, N. Y.: C. W. Bardeen. Pp. 253. $2.

Groszmann, M. P. E. A Working System of Child Study for Schools. Syracuse, N. Y.: C. W. Bardeen. Pp. 70. 50 cents.

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Hardy, Mrs. A. S. The Hall of Shells. New York: D. Appleton and Company. Pp. 176. 60 cents.

Harvard College, Report of the Committee on Composition and Rhetoric. Pp. 118.

Holbrook, M. L. Stirpiculture. New York: M. L. Holbrook & Company. Pp. 192. $1.

Holt, L. Emmett. The Diseases of Infancy and Childhood. New York: D. Appleton and Company. Pp. 117.

Imperial University of Japan. Calendar for 1896-'97. Tokio. Pp. 527.

Lake Mohonk Conference on International Arbitration: Report of the Third Annual Meeting. Martha D. Adams, Secretary. Pp. 150.

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Norton, W. H. Artesian Wells of Iowa. Des Moines: Iowa Geological Survey.

Pollock, Mrs. Louise. The Mothers' Council; or, The Kindergarten in the Nursery. Boston: De Wolfe, Fiske & Co. Pp. 91.

Reprints. Bangs, L. Bolton: Stricture of the Urethra in Children. Pp. 13.—Gilbert, G. K.: Modification of the Great Lakes by Earth Movement. Pp. 12.—Howard, William Lee, Baltimore: Psychical Hermaphroditism. Pp. 8; Alcoholic Maniacal Epilepsy. Pp. 4; The Practical Use of Suggestive Therapeutics. Pp. 11; Pederasty *versus* Prostitution. Pp. 7.—Irwell, Lawrence, Buffalo, N. Y.: Racial Deterioration; the Increase of Suicide. Pp. 12; The Relation between Phthisis and Insanity. Pp. 29.—Linton, Edwin: Notes on Larval Cestode Parasites of Fishes. Pp. 36, with Notes.—Mapes, C. C.: Notes on Suicide. Pp. 14.—Stuver, E., Rawlins, Wyoming: How does our School System Influence the Health and Development of the Child? Pp. 31.—Thomas, Cyrus: Day Symbols of the Maya Year. Pp. 60, with plates.—Tyler, A. A.: The Nature and Origin of Stipules. Pp. 49, with plates.

Rosenthal, Dr. Joseph. Ueber Röntgenstrahlen (On the Röntgen Rays). Munich: Allgemeine Zeitung. Pp. 8.

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United States Geological Survey. Seventeenth Annual Report. Part III. Mineral Resources of the United States. Pp. 1058.—Monographs: Geology of the Denver Basin in Colorado By S. F. Emmons and others. Pp. 556; The Flora of the Amboy Clays. By J. S. Newberry. Pp. 260; The Glacial Lake Agassiz. By Warren Upham. Pp. 658; The Marquette Iron-bearing District of Michigan. By C. R. Van Hise and W. S. Bayley, with a Chapter on the Republic Trough. By H. L. Smith. Pp. 6081.—List of Publications. Pp. 69.

Waldstein, Louis, M. D. The Subconscious Self and its Relation to Education and Health. New York: Charles Scribner's Sons. Pp. 171. $1.25.

Waterloo, Stanley. The Story of Ab: A Tale of the Time of the Cave Men. Chicago: Way & Williams. Pp. 351. $1.50.

Fragments of Science.

Unselfish Science.—One of the happiest features of the opening session of the American Association at Detroit was the welcoming address of ex-Senator Thomas W. Palmer. Amid the general scramble for money power which characterizes the present age, he said, "it is gratifying to know that there is an increasing number of men and women who, ignoring the common objects of ambition, have devoted themselves to and are diligent in the unselfish pursuit of truth." These men and women find in the phenomena of Nature history related with accuracy and predictions certain to be verified. "Formerly it was considered that there was a conflict between science and religion. Let us hope that that day has long been passed, and that the more enlightened public recognizes that religion has to do with the spiritual nature of man and science with physical phenomena." The speaker had been seeking a definition of science, and conceived as the most satisfactory one to his mind "the classification of phenomena to the end that principles may be established and declared from which may be deduced rules of action that shall be applicable to particular cases. When did science first originate? Back of the dawn of history, when primeval man, emerging from the shelter of the cave before he had even built him a hut, commenced to apply the force of Nature to his use. . . . How did science originate? By extended observations, experience, and comparison. The first savage who played in the water with his reed as a baby does with a straw, blowing and sucking it, gave the first illustration of hydraulics. The little savage playing in the woods at the ancient game of seesaw would find that the heaviest boy would have to sit nearest the center, and this would give the first suggestion of the lever."

The Beginning of Photography.—A bust of Daguerre, the inventor of the pioneer of all photographic processes, was dedicated at Bry-sur-Marne, where he died, June 27th, in the presence of representatives of the French Government. The idea of fixing by some chemical process the pictures which were formed on the screen of the camera obscura had been entertained, and many persons had tried to discover the art before

Daguerre was born; but it was left for him, with the co-operation of Niepce de Saint-Victor, to accomplish the object. Daguerre was not a chemist or physicist, but a decorative painter, who when business was slack was not above painting theater scenes and panoramas, which had been introduced into France by our Fulton; and he derived much profit from a diorama which he exhibited with Bouton from 1822 to 1830. While thus occupied he met Niepce, a man of scientific knowledge but none of business. He told Daguerre of some experiments he had made in heliography, and a proposal of partnership followed in 1826. Niepce, however, never reached a practical result, but died in 1833, leaving a son who continued his researches. Daguerre in the meantime had acquired some ideas in chemistry and knew all Niepce's secrets, but was not able to use them alone. He formed another alliance with the son. In 1839 this younger Niepce called Daguerre into his laboratory and showed him a complete image fixed upon a silvered plate—the first daguerreotype. From this the photographic art has been developed by a succession of brilliant discoveries. No exact mathematical award of the merit of the invention can be made between the partners, but they must receive each an undivided share alike; but Daguerre has certainly reaped the wider fame. The discovery created a great sensation. In order that it might be placed immediately at the service of the public, the French Chambers, on motion of Arago, awarded pensions of six thousand francs to Daguerre and four thousand francs to Niepce as the price for which it should be made free.

The Career of a Floating Bog.—Floating bogs are very prominent features in some of the lakes of Minnesota. They have not, however, been found very abundant by Mr. Conway MacMillan in the Lake of the Woods. As developed, Mr. MacMillan says, the floating bog comes to have some characters peculiarly its own, due to its moving about in the water and its removal from any particular point of attachment. A redistribution of its component plants takes place, and the peripheral areas are specialized from the central. A group of plants may be distinguished at the water's edge, able to bear the lapping of the waves and enjoying the higher illumination. At the center of the island shrubs, or even small trees, may become established. Drifting about from one shore to another, touching at different points, and frequently exposed to strong winds while in transit, the bog becomes a resting place for numerous varieties of light seeds. It is, further, sometimes colonized by the plants of the region near which it may be situated. Thus the number of species of plants established upon it tends to rise; and floating bogs of long standing are scenes of very sharp struggle for existence among a considerable number of alien plants. The undulating movement communicated to the bog when exposed to wave action loosens somewhat its tangled network of roots and decayed organic substances, so that the nature of its soil is modified. The presence of the lake water underneath every part of the formation keeps it cool and moist beyond what is possible in an attached morass. These various conditions are sufficient to give the floating bog a population distinctively its own. It often happens that after floating for a season or two, or even for a number of years, a bog is carried into some angle or cove from which it does not readily escape, and may become anchored there. It is then subjected to the influences of the new environment, and is modified accordingly.

Limits of the Power of Hearing.—Lord Rayleigh began a lecture at the Royal Institution on The Limits of Audition by observing that one of the latest determinations of the frequency of vibrations to which the ear is sensitive gave the lower limit as twenty-four complete vibrations a second, and the upper as about twenty thousand a second. These limits are, however, very ill-determined, because the matter depends largely on the vigor of the vibration and the individual ear. Old people do not hear high notes which are audible to young persons, and the speaker had reason to believe that babies hear notes which persons twenty or thirty years of age can not detect. Experiments on the extent of vibration necessary to audition were described, which appeared to show that a vibration having an amplitude expressed in centimetres by a fraction having eight for its

numerator and one, followed by eight ciphers, for its denominator could still affect the ear. To make a comparison with the limits of microscopic vision, the vibration that is just perceptible to the ear would have to be multiplied by one hundred before it could be seen by any possible microscope; or, put in another way, the sensitiveness of the ear is such that it could distinguish differences of pressure one hundred times less than the residual pressure of the best vacuum, which is to be measured in millionths or less of an atmosphere.

Early Traction Cables.—The first use of cables for transmitting power to a distance —telodynamic transmission—was made, according to Prof. W. Cauthorne Unwin, in 1850, at Lozelbach, Alsace, when some large factories which had been idle for nine years were started up again. The buildings were scattered at considerable distances apart, and there was only one steam engine. A steel band, working like an ordinary machine belt, was introduced for driving one of the factories about two hundred and fifty feet from the engine. It was mounted on pulleys a little more than six feet in diameter and making one hundred and twenty revolutions per minute, and was used for eighteen months, transmitting twelve horse power. On the suggestion of an English engineer, a wire-rope cable, a quarter of an inch in diameter, was then substituted for the band, while the same pulleys were used, with grooves turned in the rim to hold the cable —till after a few years they were replaced by pulleys of iron. A transmission to a distance of seven hundred and fifty feet was next arranged, with cables running on pulleys ten feet in diameter, at a speed of about fifty feet per second, and transmitting forty horse power, which, with pulleys at mid-distances, are still in use. The amount of work transmitted by a cable is proportionate to the amount of effectual tension in the cable and its speed. The strongest material should be used for the cables, and they should be run at the highest practicable speed. The largest cables which it appears practicable to use are about one inch in diameter. In order that the bending stress may not be excessive, the pulleys are of large diameter, usually from twelve to fifteen feet. Gutta-percha, soft wood, and leather have been used for the throat of the pulley, on which the rope runs. The greatest speed at which it is practicable to carry the rope depends upon the centrifugal tension of the pulley, and is usually about one hundred feet per second. With pulleys from three hundred to five hundred feet apart, a one-inch rope will transmit about three hundred and thirty horse power.

Dahlias and "Cactus" Dahlias.—The first dahlias seen in Europe grew in the Botanical Gardens at Madrid, in 1789, from seeds sent from Mexico. The flowers were "single" and had eight rays disposed in a circle around the yellow disk. The first double forms were produced in Louvain, Holland, in 1814, after three years' work. All members of the composite family that have been through the process of doubling and have enough flexibility to entitle them to extended cultivation exhibit, Mr. Wilhelm Miller says in the Bulletin of the Cornell University Experiment Station, at least three strongly marked tendencies — to reproduce single forms; to develop large globular flowers that are completely double; and a tendency toward what are called pompons. The single varieties are the most natural and the easiest to produce and fix, while the large-flowering and pompon varieties are to a greater extent products of art. The large-flowering varieties are the hardest to produce and the most uncertain. These somewhat conventional and artificial forms are still supposed to be essential to the nature of the dahlia; but they are not. In the evolution of the dahlia too much attention has been paid to color and not enough to form. The twelve hundred varieties catalogued in 1841 "were too much like twelve hundred variously painted balls of two sizes. No new or original idea found place in the evolution of the dahlia till 1873, when the first "cactus" dahlia, *Juarezii*, was produced. Instead of short, stiff, artificially formed rays, it has loose, flat rays with pointed or twisted ends, and the peculiar red that is associated with the cactus. Other colors have since been developed, which are not that of the cactus, and that part of the name of the class is no longer appropriate. Only the rays have been cultivated, while

the disk flowers have been neglected. In the chrysanthemums, by cultivating both, a bewildering variety of forms have been obtained. It may be many years before the disk flowers of the single dahlia can be drawn out to so great a length as in some of the chrysanthemums; "but it can be done, and there is no reason in the nature of things why we should not have a race of dahlias analogous to the anemone-flowered chrysanthemums." The chrysanthemumlike forms are already some of the best we have.

Animals' Stores.—A writer on Animals in Famine observes in the London Spectator that if we examine the stores made by most of the vegetable-eating animals that lay by a "famine fund," we shall find "a rather curious similarity in the food commonly used by them. They nearly all live on vegetable substances in a concentrated form—natural food lozenges, which are very easily stored away. There is a great difference, for example, between the bulk of nutriment eaten in the form of grass by a rabbit and the same amount of substance in the 'special preparation' in the kernel of a nut, or the stone of a peach, or the bulb of a crocus, off which a squirrel makes a meal. Nearly all the storing animals eat 'concentrated food,' whether it be beans or grain, hoarded by the hamster, or nuts and hard fruits by the squirrel, nuthatch, and possibly some of the jays. But there is one vegetable-eating animal whose food is neither concentrated nor easy to move. On the contrary, it is obtained with great labor in the first instance, and stored with no less toil after it is procured. The beaver lives during the winter on the bark of trees. As it is not safe, and is often impossible, for the animal to leave the water when the ice has formed, it stores these branches under water, cutting them into lengths, dragging them below the surface, and fixing them down to the bottom with stones and mud. This is more difficult work than gathering hay."

Ancient Man in the Delaware Valley.—At a joint session of the Geological and Anthropological Sections of the American Association, held for the discussion of the Evidences of the Antiquity of Man in the Delaware Valley, Professor Putnam gave a general review of the whole subject and of the statements made by Dr. Abbott in 1883 of the finding of supposed palæolithic implements in the gravels near Trenton, N. J. The more important of the facts brought up have already been noticed in the Monthly. During the investigation of the region under Professor Putnam's supervision, in which every foot of the tract—half a mile long and one hundred feet wide—was dug over, photographs were taken of the chipped stones as they were found *in situ* in the sand and clayey deposits. These photographs and the specimens themselves were exhibited to the sections. While himself convinced that the argillite implements found in this site were the work of men anterior to the Indians, he had invited other archæologists and geologists to visit the place and investigate for themselves. Several had done so, and had reached conclusions similar to his and Dr. Abbott's as to the antiquity of the argillite remains. Papers were read by G. N. Knapp, H. B. Kummel, Prof. Thomas Wilson, Dr. H. C. Mercer, and Prof. R. D. Salisbury substantially in agreement with these views. Prof. G. F. Wright held that the formation of the clay indicated the action of water, thus further attesting the great antiquity of the find. Prof. W. H. Holmes held that the implements simply indicated the beginning of the Indian in that region. He thought the sand was piled up by the action of the winds, but did not touch upon the presence of the clay.

Ingenuity in Bow Making.—To establish the point that environment is not the cause but the occasion of industries, and that the true source of all arts must be sought in the ingenious human creature, Prof. O. T. Mason cites the fact that the withholding or the concealment of gifts by Nature acts as a stimulus to ingenuity. "Take, for example, the bow. There are regions where the wood for this implement is perfect, as in South America or the hard-wood forests of the eastern United States. Here the very embarrassment of riches leads men to be satisfied with a very poorly made bow. Now, the characteristics of a good bow are rigidity and elasticity. When our ingenious friend the Indian climbed the eastern slopes of the Rocky Mountains away from the hard-

wood forests, he invoked the mammals to yield the sinew from the leg or the scapula, and with this he glued an elastic back upon his poor implement or united two or three horns so as to get his effect, the middle piece giving the columnar resistance, the wings putting to flight the arrow. By and by you approach the hyperborean man and ask him how he is going to have a bow. It is true that he has only brittle driftwood, that glue will not hold in his cold and damp clime, and that materials for arrows are scarce. The result of this is the sinew-backed bow and the harpoon arrow, together the most complicated and ingenious device ever contrived by a savage mind. The bow wood has one virtue, that of rigidity. By an ingenious wrapping of hundreds of feet of fine sinew thread or braid from end to end along the back with half hitches on the limbs at every danger point the virtue of elasticity is added, and you have one of the most quickly responsive implements in the world. The arrow is quite as cleverly conceived."

Value of Pure Mathematics.—The presidential address of Prof. A. R. Forsyth in the Section of Mathematical and Physical Science of the British Association related to the value of the study of pure mathematics aside from the consideration of any applications that may be made of it. By some, mathematical study is regarded as useful only as it affords means for arriving at results connected with one or other of the branches of natural philosophy; by others, as it may possibly apply to practical issues. To the former class of critics the author cited instances in which the utilitarian bias in the progress of knowledge has not been the best stimulus, or in the long run the most effective guide toward securing results; to the others he maintained that mathematical students are justified in not accepting practical issues as the sole guide by the consideration that such issues widen from year to year and can not be foreseen. Moreover, if such a principle was adopted many an investigation undertaken at the time for its intrinsic interest would be cast aside unconsidered, because it did not satisfy an external test that really had nothing to do with the case, and might change its form of application from time to time. Among instances in which the purely mathematical discovery preceded the practical application and was not an elucidation or an explanation of observed phenomena, are cited the principles of conic sections, known to the Greeks two thousand years before Kepler and Newton found in them the solution of the universe; the methods of analysis by the application of which the discovery of the planet Neptune was attained; the reasoning on the properties of wave-surfaces by the use of which Sir William Hamilton inferred the existence of conical refraction; and the theory of functions, in which the purely mathematical interest was deemed supreme, which has found application in the investigations of Lagrange and others on the construction of maps; in investigations on discontinuous two-dimensional fluid motion in hydrodynamics; in the dynamics of a rotating heavy body, in various questions in electrostatics, and in some of the recent advances in physical astronomy. In the field of natural philosophy mathematics will furnish more effective assistance if in its systematic development its course can freely pass beyond the ever-shifting domain of use and application.

Curiosities of Zoölogy.—Prof. L. C. Miall observes, in his sectional address at the British Association, that zoölogists may justify their favorite studies on the ground that to know the structure and activities of a variety of animals enlarges our sense of the possibilities of life. Surely it must be good for the student of human physiology, to take one specialist as an example of the rest, that he should know of many ways in which the same functions can be discharged. Let him learn that there are starfishes whose nervous system lies on the outside of the body, and that in other animals it is generally found there during some stage of development; that in certain animals the circulation reverses its direction at frequent intervals; that there are animals with eyes on the back, on the shell, on limbs and limb-like dependencies, in the brain cavity, or on the edge of a protective fold of skin; that there are not only eyes of many kinds with lenses, but eyes on the principle of the pin-hole camera without lens at all (nautilus), and of every lower grade down to mere pigment spots; that auditory organs may be

borne upon the legs (insects) or the tail; that they may be deeply sunk in the body and yet have no inlets for the vibrations of the sonorous medium (many aquatic animals). It is well that we should know of animals with two tails or with two bodies permanently united; of other animals developed within a larva which lives for a considerable time after the adult has detached itself (some starfishes and nemertines); of animals which lay two or three kinds of eggs; of eggs which produce two (an earthworm) or even eight embryos apiece; of males which live parasitically on the female, or even undergo their transformations, as many as eighteen at a time, in her gullet; and of female animals which are mere bags of eggs. The more the naturalist knows of such strange deviations from the familiar course of things the better will he be prepared to reason about what he sees, and the safer will he be against the perversions of hasty conjecture.

The Life of the Toad.—From a study of the toad, by Mr. A. H. Kirkland, we learn that in this region it usually emerges from its hibernating quarters during April. Cold weather retards its movements, but on warm days in the spring the toads make their way to the ponds and stagnant pools. Mating is begun as soon as the water is reached, or even before, and in a few days the long slimy "ropes" of eggs deposited by the female may be found in the pools. The eggs are nearly black, and rapidly increase in size. In two weeks the young tadpoles are clearly outlined, and in three or four weeks the eggs hatch. The vegetable detritus of the pond bottoms and the slime and algæ attached to sticks, planks, etc., seem to be the common food of the tadpole. Warm weather favors the growth of the tadpoles, and usually the young toads are fully developed, leave the water, and spread over the fields. At this stage they are extremely sensitive to heat, and secrete themselves under leaves, stones, rubbish, etc., during the day; but after a hard shower they come out by thousands. Observations of the toad's feeding show that eleven per cent of its food is composed of insects and spiders beneficial or indirectly helpful to man, and eighty per cent of insects and other animals directly injurious to cultivated crops or in other ways obnoxious to man. Their stomachs can accommodate enormous quantities of food, and one will consume in twenty-four hours an amount equal to that required to fill the stomach four times. It is estimated that in one season a toad might destroy cutworms which would otherwise have damaged crops to the extent of $19.88. The toad thus renders conspicuous service to farmers, and gardeners and greenhouse owners could make it of special use. As there are laws for the protection of insectivorous birds, why should there not be as stringent legislation against the destruction of toads? If merit of service rendered to man be the standard by which legislation is determined, the toad presents a record which will compare favorably with that of any insectivorous bird.

Magnitude of Mexican Ruins.—Of the ruins of ancient cities in Mexico which Mr. W. H. Holmes has examined and described in his publications respecting them in a comprehensive scientific manner, none, perhaps, are more remarkable and extensive as a whole than those near the city of Oaxaca. Many of the important works here are found on mountain tops, "and one soon comes to recognize the notched profiles of the ridges and peaks that border the valley as being due to the strangely directed enterprise of the ancient inhabitants. The feeling of surprise induced by this discovery is followed by one of amazement as the real nature of the work dawns upon the mind. As the explorer climbs the slopes and picks his way from summit to summit, he is fairly dazed by the vast array of pyramids and terraces, which not only crown the heights, but overspread the steep slopes, destroying traces of natural contour and making the mountains actual works of art." Climbing one of the larger pyramids of the group on the summit of Monte Alban, the author obtained a magnificent panorama of the mountain and the surrounding valleys and ranges. "Turning to the north, the view along the crest was bewildering in the extreme. The crest of Alban, one fourth of a mile wide and extending nearly a mile to the north, lay spread out at my feet. The surface was not covered with scattered and obscure piles of ruins, as I had expected, but the whole mountain had

been remodeled by the hand of man until not a trace of natural contour remained. There was a vast system of level courts inclosed by successive terraces and bordered by pyramids on pyramids. Even the sides of the mountain descended in a succession of terraces." But San Juan Teotihuacan, twenty-five miles northeast of the capital, in the magnitude of its remains and in the evidence the site furnishes of population and antiquity, "easily stands at the head of the ancient cities of Mexico. It lacks the well-preserved, sculpture decorated buildings found elsewhere in Mexico and Central America"; . . . but if the entire mass of the ruined structures of either Chichen, Uxmal, or Mitla was to be heaped up in a single mound it would hardly surpass the great Pyramid of the Sun alone in bulk, and the whole bulk of the Teotihuacan remains is many times that of its chief pyramid."

Significance of the Totem.—The Import of the Totem was the subject of a paper read by Miss Alice C. Fletcher before the Anthropological Section of the American Association. The Omahas have two totems, the social and the individual. In the course of the ceremonial attendant upon reaching puberty the young man fasts till he falls into a trance. If he sees or hears anything while in that condition, that becomes the medium through which he obtains supernatural power. He must seek and slay the animal he saw and preserve some part of it. This memento is his totem. Its efficacy is based on the Omaha's belief in the continuity of life, which links the visible to the invisible, binds the living to the dead, and keeps unbroken the thread of life running through all things, making it impossible for the part and the entirety to be dissociated. Thus one man could gain power over another by obtaining a lock of his hair. The totem opens a means of communication between man and the various agencies of his environment, but it can not transcend the power of its particular species; consequently all totems are not equally potent. Men who see the bear are liable to be wounded in battle. Winged forms give the faculty of looking into the future and controlling coming events, while thunder gives ability to control the elements and authority to conduct certain religious rites. The simplest form of the social totem is in the religious societies, the structure of which is based upon the grouping together of men who have received similar visions. Applied to the gens, or tribal body, the object of the totem was to teach the people the knowledge and duties of kindred, and one of the most important of these duties was the maintenance of the union of the tribe. The gentile totem gave no immediate hold upon the supernatural, as did the individual totem to its possessor. Outside of certain rites it served solely as a mark of kinship, and its connection with the supernatural was manifest only in its punishment of violations of the taboo. Its inculcation was that the individual belonged to a definite kinship group, from which he could never sever himself without incurring supernatural punishment.

The Moon and the Sabbath.—The Rev. R. J. Floody presented to the American Association the results of ten years' research into the origin of the week and holy day among primitive peoples. He found that they were widespread among the nations of the ancient world from very early times. Each of these peoples is assumed to have independently originated the Sabbath and not to have received it second hand from other tribes. To account for the unanimity in observing this universal custom among so many races, we must look for its source in some pheomenon of Nature common to all. The prominence of seven as a sacred number among ancient peoples is due to the moon. Each lunation has four phases or quarters, averaging about seven days apiece. Nature worship was the earliest form of worship among primitive peoples, and the moon took precedence among objects of Nature. When the new phase of the moon appeared, men worshiped it, showing their honor and respect by sacrifices and then a feast. They would naturally rest from labor most of the time to give attention to the feasts. Work on the sacred day was considered inauspicious. This early week was the rough and ready reckoning of men devoid of the use of astronomical instruments. The holy day was not the seventh day of time, but the seventh day of the moon. The difficulty of getting the exact number of days of the lunar week

to fit into the lunar month led to the substitution in some of the nations of three weeks of ten days each. The author substantiated his theory by citations from the literature and traditions of many peoples.

Hindu Godlings.—The godlings or inferior deities commonly worshiped by the masses of the Hindus, and described in Mr. W. Crooke's book on the Popular Religion and Folklore of Northern India, are of very different character from the exalted conceptions of divinity described in the Vedas and known to the select among high-caste Brahmans. They are very numerous, and are described under the five headings of the godlings of Nature, heroic and village godlings, the godlings of disease, the sainted dead, and the malevolent dead. The godlings of Nature include the sun, the moon, the demon of the moon's eclipse, the rainbow, the Milky Way—known also as the pathway of the snake or the course of the heavenly Ganges—Mother Earth, thunder and lightning, the sacred junctions of rivers, sacred wells and lakes, hot springs, waterfalls, sacred mountains, hail and whirlwind, aërolites, etc. The great rivers, especially the Jumna and the Ganges, stand very high in the list of benevolent Nature godlings. The heroic village godlings form a numerous class; and there seems to be confusion between some of them and some Mohammedan saints in high repute. The current from a ventilator placed at the tomb of one of these saints to furnish fresh air to the pilgrims was believed by them to be his holy breath, and they went round to worship it. The godlings of disease are mostly goddesses, and are forms of Kali, the goddess of death. There is a goddess of cholera, and one of smallpox, but none of the plague; whence it is inferred that that disease is new to India. The belief in the good luck of horseshoes is common in India, and so is the custom of throwing rice after brides.

Classification of Fibers.—While engaged in cataloguing the fibers of the world, Charles Richard Dodge found that a better classification was needed, and has published the scheme which he devised. Besides the popular understanding of the term fiber as relating to those forms of filamentous substance that can be spun and woven or twisted into cordage, he would include under it rougher substances that are plaited. In his classification two groups of fibers are recognized, based on cell structure. The first group includes fibers with fibro-vascular structure, embracing three groups: bark fibers, derived from the inner bark of exogenous plants; woody fibers, comprising barked stems or twigs, roots, the split wood of exogenous plants, and wood-pulp; and structural fibers, derived from the structural system of endogenous plants. The second group—fibers of simple cellular structure—comprises surface fibers, including the down or hairs surrounding exogenous seeds or their envelopes; the hairlike growth found on stems, leaves, and buds; fibrous material produced in the form of epidermal strips from the leaves of palms, etc.; and false fibrous material—mosses and leaves used for packing, and certain fungous growths. It is the consideration of these useful native fibers that makes it possible to enumerate a thousand species of fibrous plants, while the world's commercial fibers would hardly reach a total of fifty species.

MINOR PARAGRAPHS.

In his sectional address on the Labor Question before the British Association, Prof. E. C. K. Gonner drew a parallel between the present age and the Renaissance. Analogies between the present period and that of the fifteenth and sixteenth centuries offer themselves in different ways. Then, as now, the time was one of discovery, and the discoveries of either period have had effects both destructive and constructive—destroying opinions resting on certain narrow conceptions of the sphere of life, but giving opportunity for new ideas and vaster conceptions. Each period was a time of a new learning, and in both knowledge has been sought in a return from theories rigid and out of consonance with life to life itself and the facts of life. In the sphere of religion and morals the likeness is strangely evident. In both cases there was failure to distinguish between the fleeting form and the abiding reality, and there were particular tendencies, largely by

way of result, affecting morals and conduct. In the fifteenth century, as now, these latter were not so much in the direction of that coarseness which somehow or other is often called immorality, but rather in that of a lack of moral discrimination and will. The mediæval Renaissance found its salvation in the emphasis of individuality, alike in religion, in the state, and in industrial activity. At the present we seem tending in another direction, and seeking a positive moral guidance in an enlarged conception of social duty and solidarity; and the position which employed labor occupies in regard to them is sufficient to insure it sympathetic attention.

Morocco, by reason of its geographical position and the peculiar distribution of its mountains and valleys, enjoys, according to Mr. Charles Rolleston, the varieties of climate between those of the north of Scotland and the plains of India. Its productions are also varied, and under a good administration would be valuable. With extortionate taxation and the insecurity of property industries languish. The sugar cane was introduced by the Arabs during the middle ages, but the profitable nature of the crop exposed the owners to oppression, and the former rich plantations have become things of the past. Most of the country is well adapted to horticulture, but the almost prohibitory export duties prevent a trade which might go far toward supplying the fruit markets of Europe with oranges, lemons, dates, peaches, plums, apricots, grapes, figs, pomegranates, mulberries, and olives. The empire is also rich in minerals and in agricultural products. With all these munificent resources Morocco has fallen into decadence, simply on account of the vice of its political administration, which does not fulfill a single function, duty, or responsibility of the government, but is generally mischievous.

The serpent symbol was described by the Rev. S. D. Peet, in a paper read in the American Association, as prevalent all over this continent. It appears in effigies in Canada, Ohio, Illinois, and Minnesota. Certain myths among the Iroquois and Algonkins represent the serpent as coming out of the water, fascinating men and turning them into serpents, and taking them below the water—thus reminding one of the temptation. While in these and other myths of those nations the serpent is the source of evil, in Nicaragua and Yucatan it is the source of good. It is in reality the symbol of the rain cloud, and the crops and the seasons are dependent on its appearance. Instead of antagonizing the chief divinity, it seems to be sailing through the air, bearing that being on its back, or holding vases in its folds that empty water or rain upon the fields. In Nicaragua the serpent appears in sculpture, highly wrought and carved with great force. The sacred books of the Mayas have many representations of serpents. Even the hieroglyphics of the Mayas have serpents upon them, forming parts of the glyph. Among the Pueblos the serpent figured in a very interesting way in the ceremonies of the initiation of the youth.

In his characterizing of the Arctic Seas, Mr. J. Scott Keltie says that to the north of Europe and Asia we have the scattered groups of islands—Spitzbergen, Franz Josef Land, Novaya Zemlya, and the New Siberian Islands. To the north of America we have an immense archipelago the actual extent of which is unknown. It may be that the islands of this archipelago are continued far to the north; if so, they would form convenient stages for the work of a well-equipped expedition. It may be that they do not go much farther than we find them on our maps. Whatever be the case, it is important to the interests of science that this section of the Polar Sea be examined; that as high a latitude as possible be attained; and that soundings be made to discover whether the deep ocean extends all round the pole.

An ocellated lizard which M. Charles Dreaux kept for thirteen years grew to be nearly eighteen inches long and to weigh almost half a pound. Having come from a mild region, it was supposed not to be in the habit of hibernating, and was kept during the first winter in a warm room. It suffered thereby from the violation of its customs, and, while it continued active, did not eat, and was reduced, when spring came, to a pitiful condition. Kept in a cool room in after winters, it was regularly dormant from the latter part of October till about the middle of March, or between four and five months. Its winter slumbers were not,

however, entirely continuous, but it changed its place frequently and sometimes came out to drink. It lost between a ninth and a twelfth of its weight; molted late in May or early in June, sometimes also in July, but rarely twice a year. It is very tame and very curious. It was probably two years old when captured, and was consequently, at the beginning of 1897, about fifteen; and it shows signs of age in its diminishing agility, growth, and appetite.

Of the stations in the international series for cloud observations, Prof. Frank H. Bigelow said in the American Association that the United States has fourteen. The object of observations at all these points is to determine the actual circulation of the atmosphere at different cloud levels. Heretofore indications have been worked out from the surface of the ground, where the circulation is much distorted. The action of storms is usually strongest two or three miles above the surface. The author criticised the conclusions of German meteorologists, who have worked on theories by mathematical processes, as being ideal and not conforming to actual conditions found in Nature. He showed by maps how storms run around rather in the upper isotherms than on the ground. The form of these lines is largely determined by the relation of land and ocean. The result is that the upper currents, which would run smoothly otherwise, become distorted by their passage over the land. Storms are abnormal parts of the general circulation, and have the force of that circulation behind them.

In his experiments in photography from kites at Enlaure, near Labruguière, France, M. Arthur Batut observed that when he flew his kite with a north wind, though it was a strong one, his kite kept its balance in the air without violent jerkings; while with wind from the south or southeast, unless it was extremely light, the kite dodged hither and thither and was extremely irregular in its movements, as if there were eddies in the air stratum. The north wind reached Enlaure after blowing over a plain country, with only gentle undulations; while the south and southeast winds came from over a broken country. Aëronauts who have suffered from caprices of the wind before reaching an area of calm in the atmosphere have sometimes ascribed their trouble to eddies in the lower air strata occasioned by irregularities in the surface of the ground. The irregularities in the flying of the kite may have had a like origin.

Of the physical and mental training gathered—laboriously and somewhat wastefully, it may be—at the joiner's bench, in the fitting and turning shops, and the forge during the old course of mechanical engineering apprenticeship, Mr. G. F. Deacon expresses himself convinced that the kind of knowledge which comes of thoughtful chipping and filing and turning and forging, though only applied to a few of the materials with which in after-life the engineer has to deal, are quite as important to his future sense of rightness in constructive design as tables of density and strength. The use of such work is not merely to teach one the parts and combinations of any particular machine; to a still higher degree it is the insensible mastery of a much more subtle knowledge or mental power—the application of the senses of sight and touch and force, it may be of other senses also, to the determination of the nature of things.

An interesting memoir was recently presented to the Paris Academy of Medicine by Dubousquet-Labordaire and Duchesne concerning a group of families at Saint-Ouen, an industrial district on the outskirts of Paris, which appear to have been immune from tuberculosis for many generations. The families are at present ninety-eight in number, and consist of five hundred and eleven persons. No cases of tuberculosis have occurred among them, as far back as the memory of the oldest inhabitant reaches. They are a farming people of excellent sanitary habits, and rarely or never mix either socially or by marriage with immigrants from other sections.

Ever since aluminum has been used in construction difficulties have arisen in soldering it. The following contribution to Nature by A. T. Stanton is of interest in this connection: If cadmium iodide be fused on an aluminum plate, decomposition of the salt occurs long before the melting point of the aluminum is reached. The result is generally the violent evolution of iodine vapor, and the formation of an alloy of cadmium and

aluminum on the surface of the metal. The addition to the cadmium iodide of the two chlorides of zinc and ammonium, previously fused together, results in a flux, which readily enables tin (or other soldering alloy) to unite perfectly with aluminum.

NOTES.

MR. VERNON HARCOURT has retired from the general secretaryship of the British Association, which he has held for fourteen years; and Prof. Roberts Austen, who has for some time assisted in the work, has been chosen to succeed him.

M. B. RENAULT, a French investigator, has long been working at the identification of fossil bacteria. The general results of his observations have recently been published. He believes them to have been coeval with the first appearance of organic life on the earth, the spherical form being earlier than the rodlike. He has found indications of their presence in bone, teeth, and scales, and also in vegetable tissues. The species are, as a rule, distinct from those at present in existence.

FEW States, says Mr. John Gifford, in his report on the forestry of that State, "have been more thoroughly deforested than New Jersey. Just how to mitigate this evil without the expenditure of large sums of money and without infringing on private rights, or without adding to the expense of those who are already burdened with unprofitable land, is indeed a difficult problem on which there is great diversity of opinion. After a visit to several of the principal forest regions of Europe . . . the writer believes that great caution is necessary in this work, and that what is gained must come little by little until America has, after much experimentation, developed her own systems applicable to her varied climate, species, soils, and demands." The first and most important steps are the prevention of conflagrations and the construction of roads in forest regions.

THE method of the computation of the Chinese calendar is described by Paul d'Enjoy in the Bulletins de la Société d'Anthropologie, 1896, p. 52: "Every year is named by a combination of two words according to a fixed rule, and the special combination is supposed to indicate the fortunes of the year. The year 1896 was the period of the external hearth and the monkey; that is a time of dangers from abroad, which must be met by cunning and dexterity. In 1897 the Chinese enter into calmer times, under the auspices of the internal hearth and the chicken. Next year the combination is waste land and dog." The months, weeks, days, and hours are also described. Each of their hours corresponds to two European hours, of which seven belong to the day and five to the night. The first hour commences at eleven o'clock at night.

BEETS and beet sugar form very important elements of agriculture and manufacture in Russia. Besides supplying all the wants of the empire, the sugar is exported in considerable quantities to other countries. The cost of cultivation averages about eighteen dollars an acre. Russia ranks fourth among European nations in quantity of sugar manufactured per year. The raw sugar produced by Russian factories is said to differ but little from refined sugar, and to surpass foreign raw products. The cultivation of beets is said to have had a beneficial effect on agriculture in general throughout the empire by causing the introduction of improved types of machinery and implements.

IN connection with an account of the Kootenays of British Columbia, given in the British Association, Mr. D. A. F. Chamberlain exhibited an album of drawings made by members of the tribe, which showed a well-developed artistic taste among that people. The map-drawing was remarkably well done, and showed large tracts of country delineated with much topographical skill. The whole series is to be reproduced and published in the volume of transactions of the association.

A PAPER read by Dr. Ami, of the Geological Survey, Ottawa, at a conference of members of the British Association, described twenty-six public museums and private scientific collections in the Dominion.

DR. RUDOLPH HEIDENHAIN, Professor of Physiology and Histology in the University of Breslau, who died in October, 1897, was born January 29, 1834, was graduated at Berlin in 1854, and was appointed to the professorship in Breslau, which he held during the rest of his life, in 1859. He made valuable discoveries in physiology and contributed numerous notable papers to its literature. He published a volume of Physiological Studies in 1856, and four volumes of Studies of the Physiological Institute of Breslau between 1861 and 1868. His laboratory was the source of voluminous contributions by himself, his pupils, or his assistants to Pflüger's Archives on a large variety of special topics in the field of his studies. His essay in Hermann's Handbook of Physiology on the Secretion Processes, extending over four hundred pages, is quoted in every text-book on physiology. His later researches on lymph formation and the studies conducted in his laboratory on hæmodynamics and ferment action were very important.

SIR PETER LE PAGE RENOUF, an eminent Egyptologist, keeper of Egyptian and Assyrian antiquities at the British Museum, died in October, seventy-five years of age.